Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.
Published by McGraw Publishing Company, Inc.

Vol. 64 NEW YORK, SATURDAY, AUGUST 8, 1914 No. 6

Responsibilities During War

The succession of startling events in Europe has thrown upon this country heavy responsibilities, moral, financial and commercial. The first outward signs were the demands for gold for export and the crushing volume of liquidation which re-awakened the New York Stock Exchange to activity. The next sudden steps—the closing of the exchange, the rapid perfection of government plans to aid the financial situation, and the additional precautions of the banks to avert disaster by the use of clearing house certificates and the restriction of savings withdrawals—are now matters of history. The movement of the numerous closely associated events has been so swift that, in order to retain a clear outlook, it is essential to bear in mind the extraordinary position in which this country is now placed. Of the main countries of first rank it is the only one that is fitted to give outside help in restoring order in Europe. It alone has no alliances and is friendly with all. Those considerations may make an opportunity for moral action later. The economic wastes of prolonged war will be visited on the civilized world, being proportioned, however, in somewhat the degree of participation in war or in foreign commerce. The shrinkage in security prices here, although temporary in nature, is one of the elements to be reckoned with. This country can produce for markets which are not capable of production for themselves and in that way do much to alleviate the commercial, if not the other, horrors that are inseparable from war.

Aids for Domestic Business

President Wilson's refusal this week to heed the plea of several senators and postpone the trust legislation program almost escapes attention in the turmoil of war news. The plea was based on the argument that the prosecution of the Presidential program to the bitter end would contribute still further to the causes of unsettlement of business. Nothing stops the Washington authorities in their onward march. The President apparently can control Congress, and he is determined that corporations subject to trade legislation shall not escape. He apparently could not control the Interstate Commerce Commission, because it was generally believed in Washington that he favored the rate increases asked by the railroads; but that commission was determined that the railroads should not get what they wanted. If it had so happened that Mr. Wilson's views had failed to meet the approval of Congress and had been adopted by the Interstate Commerce Commission, the contributory causes of our industrial conditions would have been quite different. It is a matter for wonder that the Interstate commission labored so long and brought forth so little. Even the little that it did grant to the railroads is bedimmed by the "psychological" state of uncertainty in which business finds itself pending a determination of where it stands. Business just now needs all the support and forbearance that the government can give. Ordinary trade is a humdrum sort of a thing without the spectacular qualities which banks have. In the eyes of the public and the authorities its wares are not highly sensitive to daily influences as are the securities which constitute the trading commodities of the banks. Plain business cannot claim instant protection and get it on the ground that its customers are in danger of insolvency, and it is caught with a heavy load of materials in a declining market. This is not in any sense a criticism of the aid which the government wisely extended to safeguard the banking situation on whose maintenance our whole commercial integrity rests; it is a reminder that other forms of business can be helped and strengthened in their legitimate activities by a governmental policy of tolerance and friendliness.

America's Hour of Opportunity

In time of peace the value of a security is based on its stability and earning power; in time of war its price is determined by the immediate gold it will bring. The continuance of interest or dividends does not matter to the panic-crazed seller. Europe has been a constant and heavy buyer of American public utility securities for several years past. Last week, in the face of certain war, Europe rushed to sell. Naturally prices crumbled, not because the securities and the assets back of them were impaired in the slightest, but because there were a hundred times more sellers than buyers. Utilities were affected like everything else, but not in so great a degree. A number of bankers in New York's financial district have expressed almost unanimously the opinion that the outlook for electrical securities was never better. The effect of the war in Europe, in their opinion, will be extremely favorable to the electrical industries of America. These are not shallow opinions. They are the beliefs of men who are accustomed to back their views with money. Certainly there will be no decrease in the lighting load. There may be some slight temporary decrease in the demands for motor service here and there, but not much if any is looked for. On the contrary, a growth in energy consumption in the next few months is confidently expected after conditions readjust themselves as they surely will.

Important as they are, these things are of small moment compared with the tremendous possibilities that the immediate future holds for America, particularly for every branch of the electrical manufacturing industry in this country. Such an opportunity as now presents itself has never arisen before and is not likely to do so again for generations. Now of all times is the occasion for the United States to become supreme in the markets of the Western Hemisphere and of the rest of the earth that is not at war. For the last quarter of a century Germany has been laboring mightily and with success to establish markets for her goods, especially throughout Latin America. Moreover, since our new tariff went into effect the Germans have been planning a commercial invasion of the United States. With Germany at war with its neighbors on all sides, the threatening conditions have ended. To-day the United States is in the most favorable position in the world—rich, self-supporting and at peace. The Panama Canal will be opened for commerce this month. We have a new banking law that is especially designed to foster our export trade. The temporary reduction in the prices of electrical securities furnishes no cause for alarm. The real values are unimpaired. There is no ground for worry. On the contrary, there is every reason for hope and none at all for fear.

Fireproof Construction

One would suppose that experience would have shown most thoroughly the desirability of fireproof construction in central stations. Such unfortunately is not the fact. While much progress has been made in the right direction, yet the service in no small number of communities remains at the mercy of chance. The old days of two-story stations and wooden floors riddled with belt holes have fortunately gone by. Yet often, and particularly in hydroelectric plants of the smaller sort, the risks taken are almost as great. With modern cheap concrete construction it is extremely easy to secure fireproof walls. It is in the rest of the structure that serious difficulties are encountered. One can obtain a roof of reinforced-concrete slabs which is truly fireproof and yet so heavy and expensive that it is not often used for small structures. Wooden roofs are dangerously common, sometimes fireproofed so far as the exterior goes by metal or slate coverings, but a source of danger nevertheless. What is true of roofs is doubly true of floors. Nobody has yet devised a cheap and effective fireproof floor, a floor which is reasonably safe even when, as is too often the case, abundantly soaked with oil. Ground floors based fairly on *terra firma* are commonly concreted with good advantage. When local conditions render this too expensive, wood is installed, and conditions are then ripe for a future conflagration.

Various processes have been developed for fireproofing wood, some of them reputed to be reasonably efficient. Those who are interested should take up the matter seriously and see if there cannot be provided material of this sort sufficiently cheap to encourage its use wherever in electrical works it could be applied to advantage. We do not wish here in any way to detract from the virtues of any of the various fireproofing processes which have been suggested. The fact is, however, that, good as they may be, they have not yet been successfully exploited in a way to make their application convenient and common in station construction. It is time for those who are dealing with fireproof materials of every kind to co-operate with the constructors of small central stations and show them how economically to protect themselves against serious fire hazards. It is easy enough to build a fireproof structure if there are no severe limitations on the cost. It is painfully difficult, on the other hand, to build both cheaply and safely.

Electrical Drainage Pumping

Some telling facts regarding the use of electric motors for drainage pumping, an application somewhat unusual although with much to recommend it, are given elsewhere in this issue. Electrical pumping is commonplace enough, and many of the large transmission plants in the far West are doing important work in pumping water from the streams for farm irrigation. The application described is the converse of this, being the pumping of water away from the farms to save them from being inundated. Throughout the great Mississippi valley many thousands of acres of valuable lands at certain seasons of the year are so long under water during each season as to be unavailable for agricultural purposes. To deal with this situation levees must be built for cutting off the lands from the direct overflow of the streams and provision must then be made for pumping back to the stream level the water from rainfall.

The engineering features peculiar to this task are rather striking. The pumping must be irregular in amount from month to month and from year to year, following the natural requirements of rainfall and run-off, and must be against a variable head depending on the height of the rivers along the levees. In the past a number of steam pumping plants have been used in this service—for the most part simple steam engines driving centrifugal pumps. The irregular nature of the service makes the costs considerable. The costs of such plants vary from $70 to $110 per horse-power, and the discontinuous and irregular use brings the capital and upkeep charges to about one-half of the total cost of service per acre. In recent years electrical pumping plants have been introduced with excellent results. With electric pumping the costs per horse-power are little over half those of the steam plant, and as it is well known that transmitted energy can almost always compete well with steam, the gain in fixed charges is a very material one. The need of working the pumps against varying heads and hence at varying speeds has been met by using geared pumps with three available gear ratios secured by changing the pinions, so that the motors always work under advantageous conditions.

The motor rating required for pumping is generally under 50 hp per 1000 acres in the territory where the scheme has been well applied, and hence in the case of a steam pumping station the cost would be considerable for the small proprietor unless he united with others. With motor pumping a farm of moderate size can be easily cared for, and while with steam the cost per acre in a small installation would be almost or quite prohibitive, the motor plant does the work at a cost only slightly dependent on the size of the plant. In a rough way, the cost of drainage pumping, as noted in this issue, has been somewhat in excess of $1 per acre. This is not a large item of expense from the standpoint of the farmer, considering the benefits he receives. In electric pumping a considerable fraction of the money expended goes to the central station, and hence it can be readily seen that a district reclaimed from the river and covering, as many such districts do, several thousand acres would present a load well worth securing.

Dealing with the Small Consumer

In a recent paper in the *Elektrotechnischer Zeitschrift* are discussed in some detail many forms of metering devices which have been employed to furnish a cheap means of measuring the energy used by small consumers. Some of them of unfamiliar types here look promising, and American manufacturers would do well to examine somewhat into the foreign experience in these matters for the purpose of helping on the efforts of the central station in the acquisition of load from small consumers. But, as was well shown in the important article by Mr. S. E. Doane published in these columns on May 23, 1914, there is a great deal more in dealing with the small consumer than merely installing a meter of low first cost. It is perfectly feasible to obtain a large load in small units under reasonably favorable conditions. Ordinarily work of this class has been neglected in the past, but its value has now been so well established that we look toward great progress for the future. A certain proportion of the possible customers require fairly large installations—say from fifteen to fifty lamps—with use enough to make ordinary metering thoroughly feasible. Meters for loads of this class are fairly cheap and reliable, and the ordinary methods of handling commercial business work reasonably well. It is the really small consumer, using even as few as half a dozen lamps, who furnishes both the difficult problem of exploitation and a very considerable amount of revenue.

This class of business requires in the first place very careful methods of solicitation adapted to bring into line a consumer who can afford to install only a very small equipment and who has to look carefully toward the expense of installation, and in the second place provision for installation at the minimum cost and the minimum trouble to the consumer. Moreover, there must be the simplest possible system of determining the output and securing payment for it. It will be observed that the cheap meter is only an incident to the last-mentioned requirement. It is not the first cost of the present meters that makes trouble for the central station wishing to cultivate the small consumer. On the contrary, it is the cost of meter maintenance, reading and billing that makes them expensive. In a large station these items cost almost as much for the smallest consumer as for the large consumer. The overhead charges due to the meter and bookkeeping departments greatly reduce the profits when the output sold is small. It is for this reason that contract systems of one kind or another are becoming somewhat popular and successful.

Electric lighting by contract not only renders the meter unnecessary, but it always greatly simplifies the bookkeeping. A customer who is charged just so much a month or quarter, as the case may be, knows in advance how much the charges will be and the date they fall due, and the charges can be collected from him with much less trouble than is requisite in the ordinary course of meter practice. The great problem of the central station is to keep the customer from using an abnormal amount of energy not called for by his contract or operating his lamps to an unreasonable extent, leaving them turned on all night for instance. According to the experience of many who have dealt with contract lighting, these difficulties have been somewhat overestimated. Current-limiting devices check the installation of larger lamps than the contract calls for, although these involve some additional expense, and experience seems to show that they are not so necessary as might be supposed off-hand. Indeed, it is quite likely that the losses from energy thus pilfered by a group of small consumers are considerably less than the upkeep charges of the current-limiting devices. The use of lamps for unreasonably long hours is not so easily handled. Unquestionably in every system where contract lighting is undertaken there will be a certain amount of excess time use, yet most consumers are reasonably thrifty and reasonably honest, and not inclined to keep their lamps in service all night merely because there is no way of preventing their so doing.

The last word has certainly not been said either on the meter or the current-limiting device. The growth of business among small consumers is bound to bring improvements which will lessen the cost of both. Where the central station chooses one or the other scheme of operation to increase its business it must make an effective campaign for cheap wiring, preferably with payment on the instalment plan, so as to make a definite fixed addition to the monthly bill which will not fall heavily on even the smallest consumer if meters are used. The main point is to render as simple as possible the reading and billing, perhaps uniting in one man the meter reader and the bookkeeper. This result is well worth obtaining as part of the general program of making electric service a necessity rather than a luxury and bringing it close to all members of the community, rich and poor alike.

The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

Liquidation in Public Utility Stocks

From the beginning of the present political upheaval in Europe public utility stocks, both listed and unlisted, have been heavily liquidated on the part of foreign holders, in several instances driving the prices of these stocks down to record low values. European investors, and particularly the English, have been large buyers of American public utility stocks and bonds. A number of issues have been listed on the London Stock Exchange and regularly quoted there. For some weeks these securities have been coming back to this country, selling orders being executed in many cities. The principal interior exchanges for trading in these securities in this country are Chicago, Cleveland, Detroit, Cincinnati, Columbus, Louisville, Grand Rapids, St. Louis and Denver, with large trading in several issues in Boston, Philadelphia and Baltimore. For a while these securities were rapidly bought, but now the buying power is exhausted and dealers are refusing to make bids.

Utility Issues Listed Abroad

Among American public utility issues listed on the London Stock Exchange are Cities Service Company common and preferred stock, Consolidated Cities Light, Power & Traction Company 5 per cent bonds, Consolidated Gas, Electric Light & Power Company of Baltimore stocks, debentures and general-mortgage bonds, Empire District Electric Company first-mortgage bonds, Georgia Light, Power & Railways Company common stock and first-lien bonds, Kaministiqua Power Company stock and first-mortgage bonds, Mexican Light & Power Company stocks and bonds, Mississippi River Power Company common and preferred stocks and first-mortgage bonds, Montreal Light, Heat & Power Company stocks and bonds, Pacific Gas & Electric Company first and refunding general-mortgage bonds, Pennsylvania Water & Power Company stock and first-mortgage bonds, Philadelphia Company preferred stock and debentures, Shawinigan Water & Power Company stock, bonds and debentures, Alabama Traction, Light & Power Company stock and first-mortgage bonds, Havana Electric Company bonds, Manila Electric Railroad & Lighting Company stock, bonds and debentures, Michigan United Railways Company first-mortgage and refunding bonds, Portland Railway, Light & Power Company first-mortgage bonds, and Porto Rico Railways general and refunding bonds.

London Market for American Stocks

The issues having the most general market in London are those of the Cities Service Company, Alabama Traction, Light & Power Company, Mississippi River Power Company, Consolidated Gas, Electric Light & Power Company of Baltimore, and Pennsylvania Water & Power Company. It is probable that the Cities Service Company issues have suffered more than any other securities from the foreign liquidation as they had been much more generally distributed abroad, had figured much more largely in English transactions, and also had the best and widest market in this country. Large blocks of both common and preferred stocks of this company have been liquidated here in the last two weeks, forcing prices to a new low level. The board of directors has decided to defer payment of dividends, including those due Aug. 1, on the preferred and common stock in view of the present situation.

In addition to these stocks which have a market both in New York and London, several stocks of Canadian companies are traded in on the London exchange which have their market on this side in Montreal and Toronto. Among these are Mexico Tramways Company, Mexican Light & Power Company, Montreal Tramways Company, British Columbia Electric Company, Calgary Power Company, Shawinigan Water & Power Company, Toronto Power Company, Winnipeg Electric Railway Company, Brazilian Traction, Light & Power Company and several others. Brazilian Traction, Light & Power Company, the largest of these companies, having over $100,000,000 of common stock, slumped badly in Montreal and London selling and was one of the causes of the closing of the exchange in the former city.

Companies Will Earn Despite War

With great difficulty the public utility operators in this country have developed the foreign market, but they educated Europe well in public utility investments. It is thought by these operators that as soon as they war sky is cleared and financial matters have assumed some semblance of stability these securities will once more be eagerly sought by the foreign investor. As one operator remarked, the companies will furnish service during war times and will have just as large earnings. The price of the securities in the market may go down, but the earning power of the companies is the same as before.

Effects of European Conflict on Electrical Manufactures

The great struggle which is now progressing on the other side of the Atlantic has tied up the export trade of the electrical manufacturers of this country. The General Electric Company exports monthly electrical apparatus and equipment with an approximate value of $1,000,000. At the present time this company has goods valued between $300,000 and $400,000 somewhere on the seas. The Westinghouse Electric & Manufacturing Company does only a nominal export business. For the most part its patent rights in Europe have been purchased by local companies. Its South American trade, however, is large and has suffered. At present there are in New York City 150 cars loaded with freight from the Westinghouse company, and more follow each day. This freight, consigned to South America, cannot be delivered until some means of passage by water has been provided.

At the New York office of the Westinghouse company it was stated that of the company's subsidiaries in England, France, Italy and Austria only the British company pays any dividends to the American company. These dividends amount to about $85,000 a year. This, then, in case of an entire shut-down of its European branches is the most the Westinghouse company would

lose from that cause. The other subsidiaries pay no dividends to this country and the Russian company is now practically liquidated. Mr. Tripp, the chairman of the company, is now in London, but the New York office has had no advices from him.

The General Electric Company has no subsidiaries on the continent of Europe, and its only interest abroad lies in its control of the British Thomson-Houston Company. This last company, however, has not been paying dividends and at times has needed help from the home company. The General Electric Company sells its American products to foreign firms and thus creates a market. Therefore, its only loss in Europe would be in the purchase price of the British Thomson-Houston Company and in the absence, for the present, of a European market.

Effect on Domestic Business

Far more serious than the interest in foreign companies, however, is the export trade. With commerce blocked owing to the fact that Europe owns the merchant marine, it is, at least for the present, impossible to send merchandise out of this country.

There is one bright spot in the midst of all this threatening disaster. Those countries in whose control the merchant marine now lies are at war—England, Germany, France and Russia. In this age commerce cannot be completely stopped. Thus it would seem that the United States must find some means whereby exports shall be moved.

Moreover, South America has largely been supplied with electrical equipment by Germany and Austria. There are none left now to supply the South American demand but our own manufacturers. While our companies will probably not increase their gross income from sales, owing to the inaccessibility of capital, nevertheless during hostilities they will supply a much larger percentage of equipment and apparatus. Time alone can tell to what extent they will be able to retain that trade once acquired.

Progress of Trust Legislation

In view of the foreign complications into which the government of the United States has been thrust as a consequence of the war in Europe, a number of Republican senators visited the White House during the past week and asked President Wilson to consent to postpone further action at this session of Congress on the proposed anti-trust legislation. The President stated that he was determined that final action on the proposed anti-trust bills should be had at this session of Congress, irrespective of any foreign complications. He reiterated his well-known views that it will be better for business to know what is to be done in regard to legislation than to postpone the knowledge.

Following this call at the White House by Republican leaders, the announcement has been made in Washington by the Speaker of the House that Democratic representatives who have been absent must return. It is understood that a similar call will be sent out for Democratic senators.

It is expected that every vote obtainable will be necessary in both the House and the Senate for the passage of some of the amendments to the various trust bills before Congress. Even at this date there is no certainty that they will pass Congress at this session.

Other public business, in connection with the Federal Reserve Board and measures for financial relief consequent upon the war in Europe, has occupied much of the time of the House and Senate during the past week, to the exclusion of consideration of trust legislation. While there seems to be an agreement that trust legislation is to be passed, it is by no means definitely settled that it will be. So many things are happening in Washington, and may happen, that a change may come, and it is said that the President may not insist upon the passage of this legislation at this session, just as he did not insist upon his nominees for the Federal Reserve Board being confirmed without appearing before the Senate committee on banking and currency.

What little debate there has been on the floor of the Senate the past week in regard to this legislation has been over the federal trade commission bill.

On Monday the Senate spent five hours discussing the trade commission bill without reaching any conclusion. On Wednesday night at 6 o'clock the bill passed the Senate by a vote of 53 to 16. Republican senators joined the Democrats in voting for it.

House Passes Water-Power Bill

The so-called Adamson bill, relating to the construction of dams across navigable streams, was passed by the House of Representatives on Aug. 4. In accordance with its requirements, plans and specifications for such dams must be approved by the Secretary of War and the Chief of Engineers before work of construction is commenced. Approval may include the condition that water-power to operate locks, etc., be supplied without cost, or a reasonable annual charge may be made for the benefits that accrue to the grantee by the authority given under the act. The dam shall be so located as to be best adapted to a comprehensive plan for the improvement of the waterway for the use of navigation and for the full development of the water-power.

The rights granted under the act extend over a period of fifty years beginning on the date of the original approval. Upon two years' notice prior to the expiration of the grant the United States has the right to take over the property of the grantee necessary and useful for the generation, transmission and distribution of energy, the payment therefor being based on the actual cost of the lands purchased and used by the grantee and the fair value of the other properties taken over. Allowance will be made for deterioration but not for good will or profit in pending contracts.

The Secretary of War is empowered to prescribe reasonable rates of charges for energy transmitted in "interstate or foreign commerce." When the energy is used within a state having adequate regulation for rates and service to the consumer the Secretary of War will not interfere with the established rules for rates and service.

Radio Stations Must Observe Neutrality

Supplementing his general proclamation of the neutrality of the United States in the European war, President Wilson on Aug. 5 issued a specific order prohibiting radio stations within the jurisdiction of this country from transmitting or receiving for delivery messages of an unneutral nature, and from in any way rendering to any of the belligerent powers any unneutral service during the continuance of hostilities. The enforcement of the order is delegated to the Secretary of the Navy, and it was understood that censors would be placed in every foreign radio station to insure the observance of the neutrality order. Besides the more important stations including those at Sayville, L. I., Cape Cod, Mass., and Portland, Maine, it is understood that small amateur stations on roof-tops along the coast will be closed during the conflict.

Program for Convention of Electric Vehicle Association

The following preliminary program of papers and reports has been announced for the fifth annual convention of the Electric Vehicle Association of America, to be held at the Hotel Bellevue-Stratford, Philadelphia, Monday, Tuesday and Wednesday, Oct. 19, 20 and 21:

President's address, Mr. Frank W. Smith. Report of executive secretary, Mr. A. Jackson Marshall. Reports of committees: Membership and formation of sections, Mr. J. F. Becker; operating records, Mr. W. P. Kennedy; garage and rates, Mr. John F. Gilchrist; insurance, Mr. Day Baker; papers, Mr. S. G. Thompson; legislation, Mr. P. D. Wagoner; educational courses, Mr. M. W. Alexander; standardization, Mr. E. R. Whitney; traffic, Mr. D. C. Fenner; good roads, Col. E. W. M. Bailey; central-station co-operation, Mr. W. W. Freeman; parcels-post delivery, Mr. James H. McGraw; railroad development, Mr. S. G. Thompson; motion-picture film, Mr. W. C. Andrews; constitution and by-laws revision, Mr. Frank W. Frueauff.

Reports of secretaries of association sections: New England, Mr. L. L. Edgar; Chicago, Mr. F. E. McCall; Philadelphia, Mr. J. C. Bartlett; Washington, Mr. C. M. Marsh; Cincinnati, Mr. P. H. Kemble; San Francisco, Mr. J. W. Redpath; Los Angeles, Mr. J. F. Rogan; Pittsburgh, Mr. J. A. Jacques; New York; Detroit, Mr. J. W. Brennan; Cleveland; Toronto.

Papers: "Progress of the Electric Vehicle," Mr. James H. McGraw; "Unusual Applications of Electric Trucks," Mr. F. Nelson Carle; "The Motor Truck in Terminal Freight Handling," Mr. S. G. Thompson; "Electric Vehicles in Parcels Post Service," Mr. W. P. Kennedy; "The National Electric Light Association's Electric Salesman's Handbook, with Especial Reference to Its Electric-Vehicle Section," Mr. T. I. Jones; "Electric Industrial Trucks," symposium by the General Vehicle Company, C. W. Hunt Company, Automatic Transportation Company and Elwell-Parker Company; "Educating the Public to the Field and Use of the Electric Vehicle," Mr. F. C. Henderschott; "Electrical Fire Apparatus," Chief Walker of the Philadelphia Fire Department.

Twenty-fifth Anniversary of Massachusetts Electric Lighting Association

About fifty members and guests of the Massachusetts Electric Lighting Association celebrated the twenty-fifth anniversary of the organization on July 29 at the Corinthian Yacht Club, Marblehead Neck. President Charles L. Edgar occupied the chair, and an enjoyable feature of the occasion was the presentation by the association of two solid-silver bowls to Mr. Edgar and to Secretary Everett W. Burdett in token of their quarter century of loyal service to the organization. In making the presentation speech, Mr. W. Rodman Peabody, of Boston, emphasized his dependence as a former legislator upon the statement of the association, pointed out the benefits of its policy of always meeting the public half way, and referred to the vision of the industry's future which characterizes its leaders. Informal reminiscences were given by Mr. Burdett, who touched upon the sympathetic appreciation deserved by the pioneers of the central-station industry and urged the vital importance of sound arguments in dealing with legislative committees. In his twenty-five years of service he had found a frank, open policy the best for the public and the companies alike. Six of the charter members of the association attended the meeting. The following officers were elected for the ensuing year: President, Mr. Charles L. Edgar, Boston; vice-presidents, Messrs. R. W. Day, Springfield, and A. B. Tenney, Malden; secretary and treasurer, Mr. Everett W. Burdett, Boston; executive committee, Messrs. Frederick S. Pratt, Boston; Arthur E. Childs, Clinton; R. W. Rollins, Worcester; J. W. Stevens, Greenfield; Philip Cabot, Boston; Oliver Prescott, New Bedford.

At the business meeting of the association the record of legislative activities at the 1914 session was presented with comments upon the meaning of the various measures considered.

Malad River Power Rights

The Beaver River Power Company and the Great Shoshone & Twin Falls Water Power Company of Idaho have carried their fight for possession of power rights on the Malad River to the Supreme Court in the form of two appeals. The Beaver River company alleged that its permit for water from the Malad River constituted a prior right over the permit granted to the Great Shoshone company and asked that the latter company be enjoined from further use of water for power from the river. Judge Walters, of the fourth judicial district, granted the injunction and canceled the Great Shoshone company's permit. The Great Shoshone company appealed from this order and also instituted suit in the Supreme Court against the State of Idaho and the members of the land board under the administration of Governor Hawley to condemn certain State lands along the Malad River for the location of a large hydroelectric power plant, dam and reservoir.

Convention Plans of New England N. E. L. A. Section

The sixth annual convention of the New England Section of the National Electric Light Association will be held at the New Mathewson Hotel, Narragansett Pier, R. I., on Wednesday, Thursday and Friday, Sept. 2, 3 and 4. The convention program includes four sessions, scheduled as follows: Sept. 2—paper on "The Relation of Meter Maintenance to Revenue," by Mr. G. F. Atwater, New Britain, Conn.; paper on "Rates," by Mr. R. S. Hale, Boston Edison Company. Sept. 3—paper on "Old-House Wiring and Special Campaigns," by Mr. E. C. Kimball, Boston Edison Company; report of merchandising and advertising committee; report of committee on recognition of electric-vehicle interests in New England, Mr. W. H. Atkins, chairman, Boston Edison Company. Sept. 4—report of committee on overhead line construction.

Annual Meeting of Maine Electric Association at Portland

The sixth annual meeting of the Maine Electric Association was held at Portland, Maine, on July 31, headquarters being at the Hotel Falmouth. At the business session the following officers were elected: President, Mr. John H. Maxwell, Livermore Falls; vice-presidents, Mr. F. O. Eaton, Rumford Falls, and Mr. A. H. Ford, Portland; additional members of the executive committee, Mr. W. T. Cobb, Rockland; Mr. C. E. Smith, Newport, and Mr. H. D. Stevens, Fort Fairfield. Mr. W. S. Wyman, Augusta, was re-elected secretary and treasurer. After the business session a special car to the Cape Cottage Casino was furnished by the courtesy of the Cumberland County Power & Light Company, of Portland. At the Casino a shore dinner was enjoyed by about sixty members and guests.

Consolidation of Independent Ohio Telephone Companies

The plan for consolidating fifteen of the leading independent telephone companies of Ohio has been approved by the Ohio Public Utilities Commission. In accordance therewith the Ohio State Telephone Company was incorporated. Mr. H. M. Daugherty, of Columbus, who presented the case before the Ohio commission, went into the history of the development of the business in Ohio and the financial vicissitudes of some of the companies. Mention was made of the purchase of some of the properties by Eastern financial interests for the purpose of consolidation with the Bell companies and of the abandonment of this idea when the government took action against the Bell plans.

The capital liabilities of the fifteen companies, Mr. Daugherty said, are at present $25,568,000, which would be reduced to the extent of $5,396,600 by the consolidation, and then $2,850,000 would be put into improvements. The new company will have over 250,000 miles of wire and sixty-four exchanges in Ohio. This will give strength to the 600 other independent companies in the State and afford them various facilities which they do not possess now.

Mr. Daugherty said that the new company will be owned and managed by Ohio people, 72 per cent of the stock being owned within the State.

Attorney Karl Burr presented evidence to show that the fifteen companies now have outstanding $10,013,500 bonds, $5,497,450 preferred stock and $7,450,087 common stock. The new company will have $5,206,000 common stock, $4,850,000 preferred stock and $5,000,000 bonds, in addition to $8,060,200 bonds of constituent companies to be assumed, bringing $2,850,000 new money into the organization. An aggregate of $1,953,300 bonds of the constituent companies will be canceled.

Telephone engineers presented figures showing that the values of the properties included in the consolidation aggregate $26,956,682. Mr. Burr offered the commission a report covering a study of the properties and their requirements for development by Mr. Kempster B. Miller, of McMeen & Miller, Inc., Chicago, showing the necessity of providing improvements and extensions to cost about $2,539,000.

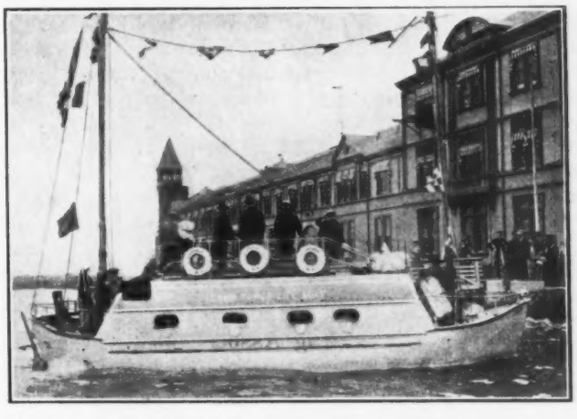
Mr. Frank A. Davis, president United States Telephone Company, said that it is the purpose to follow the report made by Mr. Miller in making improvements. He expressed the belief that the economies brought about through a central management will result in such savings that a reduction in rates might be more reasonably expected. The companies involved in the consolidation are as follows: Cuyahoga Telephone Company, Cleveland; Toledo Home Telephone Company, Toledo; Youngstown Telephone Company, Youngstown; United States Telephone Company, Columbus; Columbus Citizens' Telephone Company, Columbus; Home Telephone Company, Dayton; Washington Home Telephone Company, Washington C. H.; London Home Telephone Company, London; Stark County Telephone Company, Canton; Columbiana County Telephone Company, Lisbon; Zanesville Telephone Company, Zanesville; Findlay Home Telephone Company, Findlay; Lancaster Telephone Company, Lancaster; Massillon Telephone Company, Massillon; Citizens' Telephone & Message Company, Fostoria.

The Ohio State Telephone Company was organized by the election of the following officers: President, Mr. Samuel G. McMeen, vice-president McMeen & Miller, Inc., Chicago, and president Columbus Railway, Power & Light Company; secretary, Mr. W. L. Cary; treasurer, Mr. H. B. Taylor; chairman of the board, Mr. Frank A. Davis; executive committee, Messrs. Frank A. Davis, S. G. McMeen, F. R. Huntington and E. R. Sharp, of Columbus, and H. B. Peters, of Lancaster.

The board of directors consists of Messrs. S. G. McMeen, Frank A. Davis, F. R. Huntington, president Huntington National Bank, Columbus; E. R. Sharp, president State Savings Bank & Trust Company, Columbus; Charles A. Otis, Otis & Company, brokers, Cleveland; Harry Coulby, president Pittsburgh Steamship Company, Cleveland; F. F. Prentiss, vice-president Cleveland Twist Drill Company, Cleveland; Clarence Brown, attorney, Toledo; William Hardee, president National Supply Company, Toledo; George D. Eustis, George D. Eustis & Company, brokers, Cincinnati; A. McL. Marshall, attorney, Dayton; H. C. Kiefaber, vice-president Dayton Savings & Trust Company, Dayton; D. J. Cable, president Lima Home Telephone Company, Lima; H. B. Peters, president Fairfield National Bank, Lancaster, and Frank L. Beam, president Ohio Independent Telephone Association, Mount Vernon.

Electric Cooking, Lighting and "Wireless" on Oceangoing Lifeboat

The 36-ft. gasoline-engine-driven lifeboat *Lundin*, which left New York July 31 with a crew of seven persons aboard for a trial trip across the Atlantic Ocean, since abandoned on account of the war in Europe, is equipped with a three-plate electric stove, a 6-volt gasoline-engine starter, incandescent cabin lamps, electric fans, electric running lamps, a 7-in. search-lamp and wireless apparatus. Electricity was chosen for lighting



ELECTRICALLY EQUIPPED LIFEBOAT

and cooking in order, it is explained, to eliminate any chance of explosion or fire from gasoline vapor coming in contact with exposed flames. Other reasons for the use of electricity were, of course, its convenience and cleanliness. A 2.5-kw Sprague generator connected through a clutch and a silent-running chain furnishes energy for all of the electrical equipment and in addition charges a 12-volt, 80-amp-hr. Edison storage battery at a 15-amp rate. The battery supplies energy for an emergency 12-volt lighting circuit and for the engine starter. The boat is also wired with a 110-volt circuit of tungsten lamps fed with energy directly from the generator. The wireless apparatus has a sending range of 50 miles to 100 miles but can receive messages from a distance of 400 miles to 600 miles.

With the cessation of hostilities in Europe the trip of the *Lundin* across the Atlantic may be resumed, or she may be sent to the San Francisco Exposition by way of the Panama Canal.

Springfield (Mo.) Company Asks for Rehearing of Rate Order

The Springfield (Mo.) Gas & Electric Company, through its attorneys, Messrs. Olin, Butler & Curkeet, of Madison, Wis., and Mr. W. D. Tatlow, of Springfield, has asked the Public Service Commission of Missouri for a rehearing on the decision in the electrical rate case, rendered on June 23, as noted in our columns of July 4.

A number of grounds are stated. The decision is declared to be in violation of the constitutions of the United States and Missouri. Although an administrative body, the commission, it is stated, exercised judicial powers. The value of $300,000 placed on the property of the electrical department is questioned; the fair and reasonable present value is shown by the evidence to be largely in excess of that sum. The company also declares that the commission refused to value for rate-making purposes a large part of the property owned and used and useful in the electric service.

Concerning the finding of the commission that the interlineation made in a contract for motor service was made fraudulently to the injury of the public, the company says that such a finding is in excess of the power of the commission in that it is a purely judicial question, and that there is no evidence to support this finding.

The decision held that the supplementary contract of Aug. 16, 1912, as originally written without the erasures appearing in Article 5 thereof, is in full force and that under its terms it is the duty of the Ozark Power & Water Company not only to furnish the energy from the hydroelectric plant but to connect its transmission lines with the steam plant of the Empire District Electric Company at Joplin to serve as an auxiliary service for Springfield. This finding is declared to be in excess of the power of the commission, contrary to the great weight of the evidence and irrelevant and immaterial for the reason that there is and has been no valid contract at any time between the Springfield Gas & Electric Company and the Empire District Electric Company, and the Empire District Electric Company was never a party to the supplementary contract, nor to the original agreement between the Springfield Gas & Electric Company, the Springfield Traction Company and the Ozark Power & Water Company, dated Dec. 30, 1911. The finding by the commission that Mr. H. L. Doherty "is the principal owner and operator of the Ozark Power & Water Company, and also the Empire District Electric Company," is, the company says, contrary to fact and to the great weight of the evidence in this case.

The commission held that the respondent's relay steam plant was not necessary to be maintained at Springfield and that it was not used and useful in the furnishing of electric energy. This finding is unsupported by any evidence in this case and is contrary to fact, for the reason that since the closing of the testimony in this case there have occurred a large number of additional interruptions in the supply transmitted under the contract with the Ozark company. The evidence proved the necessity for maintaining the relay steam plant by reason of the insufficiency and uncertainty of the flow in the White River at the Ozark dam during the summer of 1912. The respondent offers to prove upon any rehearing that may be granted that the flow of the White River during the summer of 1913 was similarly insufficient and inadequate and will be in 1914 and in future years.

The commission held that the contract of sale on Feb. 17, 1913, to take effect as of Jan. 1, 1913, whereby the Springfield Traction Company transferred to the Springfield Gas & Electric Company the portion of the power and generating plant the legal title to which was theretofore owned by the Traction company was fraudulent. This finding is declared to be contrary to the evidence, in excess of the power of the commission and irrelevant and immaterial because it was the sole duty of the commission to ascertain and determine the fair and reasonable present value of all of the property used and useful in the manufacture and distribution of electric energy irrespective of the question of the ownership or title of such property. The sale did not involve any change in the real ownership of the property, because the entire capital stock and all the bonds of the Springfield Gas & Electric Company and the Springfield Traction Company were and are owned by the Springfield Railway & Light Company.

The commission erred, the company holds, in not apportioning the electrical property between the Springfield Traction Company and the electrical department of the Springfield Gas & Electric Company on the basis of use as determined by the maximum demand for electricity by the company and the department respectively. The failure of the commission to allow for going value is also attacked.

The allowance of 7 per cent as a fair and reasonable rate of return is questioned as unjust and unreasonably low. The commission proceeded upon an erroneous principle in measuring such return by a fair and reasonable return upon an adequately secured loan instead of measuring such return in proportion to the hazard and risk of a business venture.

The company says further that the commission erred in refusing to allow as a proper and legitimate expense the amount necessarily expended in good faith in properly and adequately preparing and presenting the evidence in this case to the commission, and also in disallowing as an expense all charges for managerial service and expenses by the officials and employees of the Federal Light & Traction Company and of the Springfield Gas & Electric Company other than those resident in Springfield. Errors made by the commission in its allowance for operating expenses are pointed out.

The order of the commission directed a change in rates which would cause, in its opinion, a reduction of 37 per cent below the 1913 revenues. This is declared to be unreasonable, unjust and confiscatory. Nevertheless, the rates fixed by the commission will cause a reduction greatly in excess of 37 per cent, to wit, to the extent of 50 per cent. The order further fixes rates which the company says are unjust, unreasonable and discriminatory as between the different classes of consumers.

The commission also erred in fixing the rate for electrical energy upon the basis of the operating expenses of the respondent at a time when it was using a steam generating plant exclusively and did not make any allowance for a return on capital invested in the steam generating plant.

Judge Henry Named for Maryland Commission

Governor Goldsborough has announced the appointment of former Judge W. L. Henry, of Dorchester County, Maryland, as a member of the Maryland Public Service Commission, succeeding Hon. Philip D. Laird, former chairman of the board, who resigned. The new commissioner, who is a Democrat, will take office at once and will serve about eighteen months to complete Chairman Laird's unexpired term. Judge Henry is a resident of Cambridge and is fifty years of age. Commissioner Alberg G. Towers has been designated as chairman of the commission.

PUBLIC SERVICE COMMISSION NEWS

Idaho Commission

At the request of the commission a meeting of representatives of public utility companies was held at the Owyhee Hotel, Boise, for the purpose of presenting to the commission resolutions for the standardization of operation of crossings of transmission lines, interurban systems and signal wires. The meeting was presided over by Mr. Charles E. Cochran, assistant general attorney of the Oregon-Washington Railroad & Navigation Company. Mr. Fred L. Goddard, of the Utah Power & Light Company, acted as secretary.

California Commission

The application of the Yolo County Consolidated Water Company to lease all of its property for a period of twenty years with an optional extension of fifteen years to the Yolo Water & Power Company was granted. The rental price is to be decided when the Yolo Water & Power Company shall have its rates established by the commission.

The commission dismissed without prejudice the application of the Indian Valley Electric Light & Power Company for permission to issue $81,535 bonds, on the basis that the proceeds from the sale of the bonds were to be used in the development of the reservoir site of the Round Valley Water Company, which property is now in litigation.

Massachusetts Commission

As noted in our issue of July 18, the Massachusetts Gas and Electric Light Commission ordered the reduction of the price of electric energy supplied to the residents of Cambridge by the Cambridge Electric Light Company.

The street-lighting prices were made up of a fixed charge and an operating charge. For 6.6-amp magnetite-arc lamps operating 4000 hours per year the company received $108.50 per lamp, $78.30 being paid for every such lamp operated daily until midnight. The board orders reductions to $98 in the former and $72.50 in the latter case so long as not less than sixty of each class are operated, and establishes the following prices for incandescent street and bridge lamps burning 4000 hours per year (all night and every night), so long as not less than 740 of such lamps are supplied: 50-watt lamps, $17; 75-watt, $20; 100-watt, $25; 125-watt, $29; 250-watt, $50; three-light clusters of 100-watt tungsten lamps, $60; two lamps per post of 250 watts each, one burning all night and the other until midnight, $73; 60-watt lamps burning until 10 p. m., $12.50 each. The order allows the addition of $1 per lamp per year for incandescent lamps installed in arc-lamp hoods or outer globes, and of $2 per lamp per year for incandescent lamps installed on ornamental posts, with the deductions for outage and ornamental lighting set forth in the company's schedule.

The commission points out that the company has been managed with skill and prudence, and that it serves a densely populated and compact territory having varied industries. The old prices for public incandescent lamps varied from $20.37 to $23.57 per year for 50-watt lamps to $59.86 for 250-watt units. The fixed charge varied with the type and size of lamp, though not in strict proportion to size. The variation in operating charge ranged from about 5 cents per kw-hr. for the smallest to about 3.5 cents for the largest-sized incandescent in use, and to a little over 3 cents for the all-night magnetite lamps. The board concedes that a substantial segregated investment is required for street lighting, but feels that the high load-factor of this class of service entitles the city to lower rates.

In the last five years dividends of from 10 per cent to 22 per cent have been paid on the stock, and a balance has been available for depreciation after the payment of dividends of from $2,881 to $93,167. The company contended that with an outstanding capital of $850,000 and upon an actual investment by the stockholders of $1,120,000 it was entitled to a return upon $1,700,000, because some of the stock had been issued at $200 a share. Regarding this the board says:

"It may be conceded that with respect to a company ably and conservatively managed the board is not required to consider seriously the propriety of a 10 per cent dividend. But there is a wide difference between permitting the company to earn what is, under all the circumstances, a reasonable dividend on its authorized capital and acknowledging that, as a matter of right, it is entitled to earn from now on not less than some certain definite return on its full market value. The law intended impliedly, but plainly, to limit the dividend burden. The contention of the company, on the other hand, would make the law operate to capitalize against the public the earning power of the property under existing conditions and prices. It would convert the strength and security resulting from an amount of capital low, relative to the volume of business, into a menace to the future stability of the company, and would tend seriously to impair, if not wholly to subvert, the manifest purpose of the public policy."

No recommendation was made regarding the company's general commercial lighting and motor-service rates, the justification of these, in the opinion of the commission, being found in the recent rapid development of the company's output and profits.

Indiana Commission

The Indiana Public Service Commission has authorized the Huntingburg Electric Light Company to change its service from a flat-rate basis to a meter basis. It stipulated a rate for residences of 7 cents per kw-hr., with a rate schedule ranging as low as 2 cents per kw-hr. At present there are only 450 customers in the town.

The commission has just sent letters to the local telephone companies (the Central Union and the Indianapolis) again calling their attention to their failure to comply with requests from the commission, made some time ago, that a merger be made or at least physical connection be provided for with the electric lighting and heating companies. The great duplication on the lines of the two local companies makes it practically impossible for the commission to take any action on the recent petition of the Central Union Telephone Company to revise its rates until some plan of eliminating this waste is under way.

At a conference just held by the commission practically the same steps were taken in the local lighting companies' situation. All of the lighting companies have presented petitions before the commission to revise rates downward and to eliminate alleged discrimination. Now the commission has come forward with an ultimatum to the lighting companies that some method must be found immediately to prevent further duplication of property, or the commission declares it will give the necessary orders for insuring such elimination.

The Merchants' Heat & Light Company has just been awarded the contract to light the city streets, a contract formerly held for ten years by the Indianapolis Light & Heat Company. The immense duplication of distributive property that this will entail is very apparent. This duplication is a part of that which the commission says must be abrogated, under penalty of orders from the commission compelling the companies to take the necessary steps to eliminate such waste.

Current News Notes

Building 600-ft. Towers for Panama Radio Station.—Construction work on the first of the three 600-ft. steel towers for the Darien radiotelegraph station on the Isthmus began last month. The one-story concrete power house has already been completed, as have the quarters for the operators and chief electrician. The aerial equipment will consist of three 600-ft. steel towers each having a triangular base with legs at the apexes of 150-ft. equilateral triangles.

* * *

Ways of the English in War Times.—The British-Thomson-Houston Company has an interesting agreement with the British government in times of war. The whole working force is called out by the government one afternoon and the next morning 25 per cent return as employees of the government to man the shop. Thus under war conditions the country is enabled to take over the industry with skilled and trained labor. The company is, of course, reimbursed by the government.

* * *

Jordan Rolls Once More.—Large pumping plants operated by electrical energy supplied by the Utah Power & Light Company have been installed at Utah Lake to lift water from the lake and thus maintain the normal flow of the Jordan River during the summer months when the water is so low that the crops suffer at the most critical period. In the Cache Valley electric pumps are also used to lift the water from the river to the bench lands, thereby bringing thousands of acres of land under cultivation.

* * *

Growth of the Electric Vehicle Association During 1914.—In October, 1913, the Electric Vehicle Association of America had 437 members, with local sections organized in but two cities. Since that time the enrolment has been increased to approximately 850, and sections are now flourishing in New England, Chicago, Philadelphia, Washington, Cincinnati, San Francisco, Los Angeles, Pittsburgh, New York, Detroit, Cleveland and Toronto. The association also has expectations of soon instituting local sections in Buffalo, St. Louis and three or four other cities.

* * *

Rapid Railway Installation for Utah Founders' Day.—Rapid installation of the electrical equipment of the new Salt Lake & Utah Railroad made possible the inauguration of electric-railway service from Salt Lake City to Provo, Utah, on Founders' Day, July 24, commemorating the arrival of the Mormon pioneers in the Salt Lake valley in 1847. The installation of the two substations, out-door switching stations, etc., was completed in six weeks. An immense traffic marked Founders' Day, a large number of early residents appearing to take their first rides on electric cars.

* * *

Electricity Required for Firing New Explosive.—A new submarine-mine explosive called "trotol," which cannot be set off by percussion, but which has to be confined and fired by electricity, was employed in the annual war test of submarine mines off Sandy Hook, N. J., last week. Trotol, it is declared, can be melted and handled without danger. Mines loaded with 100 lb. of the new explosive and fired during the recent test threw columns of water and pieces of targets 250 ft. to 350 ft. in the air. Each mine was allowed to remain in the water two hours before being exploded in order to test the water-tight joints in the cable containing the firing circuit.

Lamp Signals to Control New York Traffic.—Electric lamp signals are proposed for controlling the traffic on Fifth Avenue, New York City, if the scheme of traffic dispatching now being tried out with flag signals proves successful. The new plan devised by the Police Department allows Fifth Avenue traffic to move without interruption through ten-block zones. At intervals of three minutes, or the time required for this movement, the cross-town traffic, which is lighter, will be permitted to pass for fifty seconds. Green signal lamps which can be seen in daylight by the crossing policemen and by drivers of cars will be controlled by towermen in each zone. Traffic policemen at zone terminals will be provided with foot push-buttons with which they can signal the towermen when traffic is to progress. To expedite the arrangement vehicles will not be permitted to make turns to the left but will be compelled to cross the street and find a place in the opposite-bound traffic where they can progress in the direction desired by making a turn to the right. It is expected that the ten-block zone travel will eliminate the delay caused by the usual blockade at each street intersection.

* * *

SOCIETY MEETINGS

Colorado Electric Association.—The Colorado Electric Light, Power and Railway Association will hold its twelfth annual convention at Glenwood Springs, Col., Sept. 3, 4 and 5, 1914. Mr. Thomas F. Kennedy, 900 Fifteenth Street, Denver, is secretary of the association.

* * *

Cleveland Engineering Society.—Three hundred members of the Cleveland Engineering Society were entertained at Nela Park, Cleveland, Aug. 1, by officials of the National Electric Lamp Works. Mr. M. Luckiesh delivered a lecture on "Light and Its Effect in Art," which was followed by a program of athletic sports and a dinner.

* * *

American Roentgen-Ray Society.—The American Roentgen-Ray Society will hold its next annual meeting at the Hollenden, Hotel, Cleveland, Ohio, from Sept. 9 to 12. On Sept. 10 Dr. Frederick Dessauer, of Frankfort, Germany, will demonstrate a tube of his invention which, it is declared, produces X-rays of the same wavelength as the gamma rays of radium.

* * *

Dallas Electrical Contractors Entertain Neighbors.—Officers and members of the Dallas (Tex.) Electrical Contractors' Association entertained the members of the Fort Worth Electrical Contractors' Association with a smoker July 21. The event was held in the hall of the Dallas Builders' Exchange, and addresses were delivered by several contractors.

* * *

Electric Club and Jovian Outing, Chicago.—Members of the Electric Club of Chicago and the Jovian Order of Chicago plan to hold their annual basket luncheon at Ravinia Park, Ill., Aug. 20. The picnic committee, of which Mr. H. A. Mott is chairman, has provided many prizes for races and contests. These awards are now on display at the Chicago Electric Club.

* * *

Pennsylvania Electrical Contractors' Association.—At the last meeting of the Electrical Contractors' Association of the State of Pennsylvania officers were elected as follows: President, Mr. F. M. Shepard, Philadelphia; vice-president, Mr. J. S. Musser, Harrisburg; secretary-treasurer, Mr. M. G. Sellars, Philadelphia; board of directors, Messrs. M. E. Arnold, Philadelphia, and George E. Shepherd, Wilkes-Barre; national director, Mr. George E. Shepherd.

Electric-Service System at Evansville, Ind.

Combination plants furnishing electric-lighting, steam-heating and electric-railway service—Special connection of condensers—Provisions for low-pressure steam distribution

ELECTRIC lighting, district steam heating and gas and street-railway service for Evansville, Ind., as well as energy for all the interurban lines operating out of that city, except one, is now being furnished by the Evansville Public Service Company. This organization is the outgrowth and consolidation of several separate utilities, brief histories of which are given below.

In the fall of 1909 a lighting and heating franchise was secured by the former Public Service Company of Evansville, and a combination steam and generating plant was built on Mulberry Street the following year. In March, 1912, the stock ownership of the Evansville Public Service Company was taken over by the Evansville & Southern Indiana Traction Company, which operates all of the street-railway lines in the city and an interurban line to Patoka, Ind., a distance of 35 miles. During the following July the Evansville Public Service Company and the Evansville Gas & Electric Company were consolidated into the Evansville Public Service Company. About the same time the Public Utilities Company was formed and bought outright all of the property of the Evansville & Southern Indiana Traction Company. At present the physical property of the railway lines and the stock of the Public Service Company are owned by the Public Utilities Company. The present Evansville Public Service Company, which is an entirely different organization from the old Public Service Company, now furnishes both gas and electricity.

Maximum rates for electric service are fixed by franchise at 7.5 cents, and a discount of 10 per cent is allowed for prompt payment, making a 6.75-cent net rate with a sliding scale for commercial motor-service customers. On the city railway lines "pay-as-you-enter" cars have been placed in service and new track and feeder circuits installed. Now there is, of course, less likelihood of interruption to the electric service than formerly, as the two plants are being operated in conjunction with each other instead of separately. The Division Street station of this company, which has the larger equipment of the two, will, in all probability, be connected to the steam-heating system in a short time. Plans are being made to lay out 2500 ft. of 20-in. pipe to complete a loop main for district heating. Steam heat is required from about the middle of September to the middle of May. Peak loads on the electric-service system occur between 4:45 p. m. and 7:45 p. m. usually.

Eventually all energy will be distributed from the Division Street station, as the company contemplates connecting it with Mulberry Street station by two tie-lines, one to be a No. 000 circuit and the other to consist

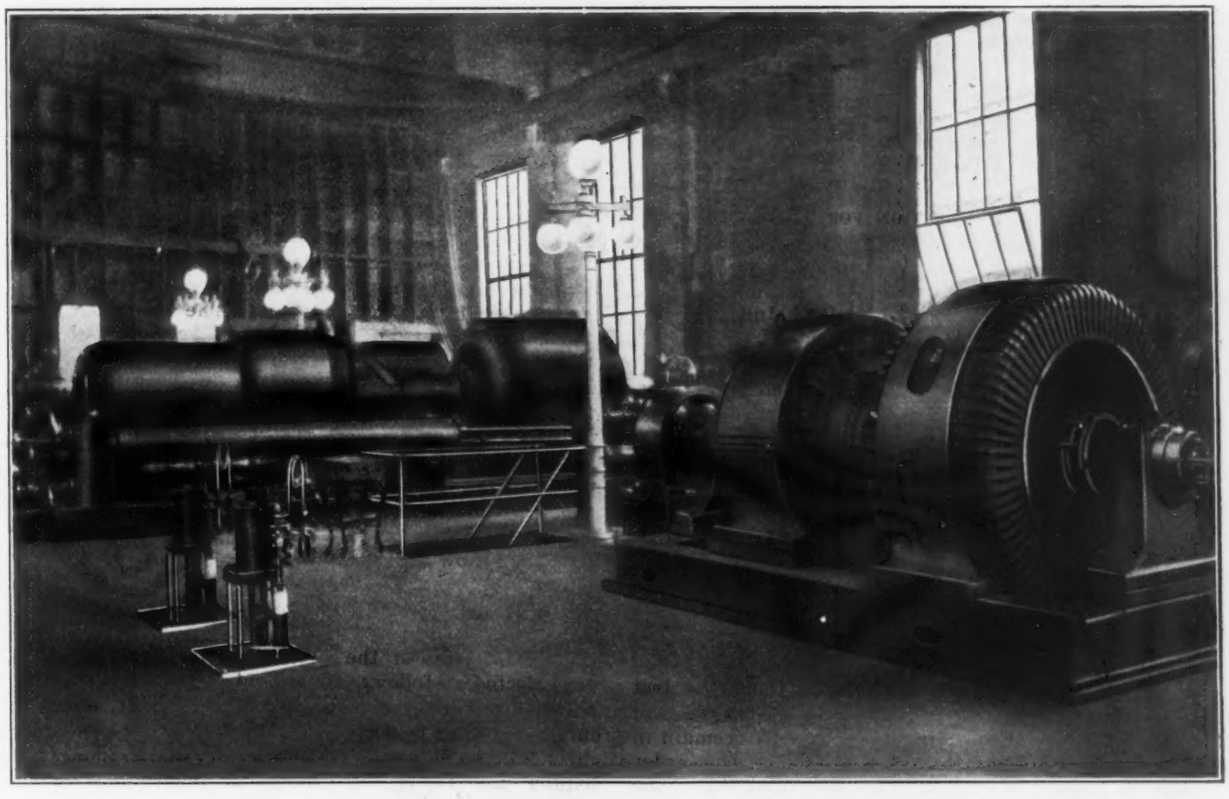


FIG. 1—GENERATING ROOM OF DIVISION STREET STATION

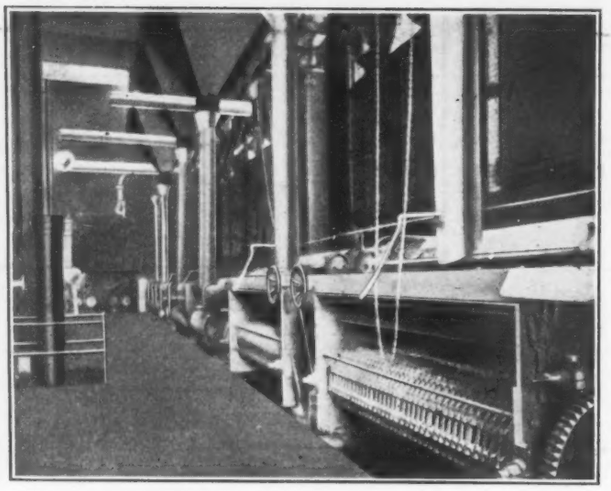


FIG. 2—BOILER ROOM, SHOWING AUTOMATIC STOKERS

of two No. 0 conductors in parallel. One of these lines is installed at present. As competing distribution lines paralleled each other in several places before the merger, advantage has been taken of the present situation to remove the older distributing circuits and supply energy over the newer lines.

The Division Street station has been remodeled, the generating equipment has been increased to 5500 kw, new switchboards have been installed and several further additions are contemplated. Before long the company intends extending the north end of the building to accommodate a new 5000-kw horizontal turbine-driven generator, a 1000-kw motor-generator set, four 500-hp boilers and another smokestack 100 ft. in height and 60 in. in external diameter.

This station, as laid out at present, consists of a boiler room on the west, a generating room adjoining it on the east, and several transformer and high-tension equipment compartments in a small annex opening off the east side of the generator room. The building is constructed of brick and concrete and measures about 157 ft. long and 135 ft. wide over all. The north wall of the building is closed temporarily with corrugated sheet iron, as any extensions which are made must be added on that side. A railroad spur enters the south side of the building where several overhead and underground coal bunkers are situated. The coal cars are unloaded into these either through dump bottoms or by means of a grab bucket. The hoppers are shaped like an inverted pyramid with openings and valves in the bottom through which coal is loaded into small coal cars in the basement.

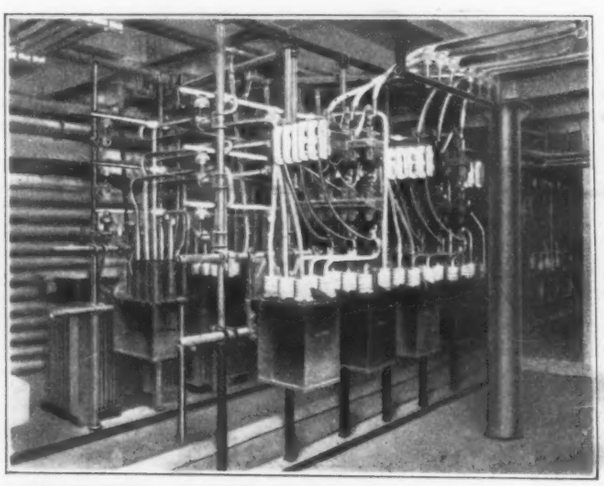


FIG. 3—OIL SWITCHES AND 2300-VOLT BUS STRUCTURE IN BASEMENT

Tracks and turntables are laid out in the basement so that these cars may be loaded from any spout and pushed to a hydraulic lift, which conveys them to an elevated track above the boilers, from which they may be dumped into steel hoppers placed between the track and the boilers. Gravity chutes provided with swivel joints extend from these bunkers down to the stoker hoppers.

Ashes and fine coal can be disposed of by reversing the process just described. Under each grate are two fine-coal hoppers and one ash hopper, which can be dumped into narrow-gage cars running on tracks in the basement. The loaded cars are hoisted on the hydraulic lift previously mentioned, the fine coal being dumped into the hoppers over the boilers and the ashes delivered to a tank built over the railroad spur. From this hopper the ashes may be dumped into the empty railroad cars beneath.

Of the six boilers installed, two are Babcock & Wilcox units rated at 510 hp each and having 98 sq. ft. of grate surface; two are Aultman-Taylor water-tube units having 4000 sq. ft. of heating surface and 90 sq. ft. of grate surface each, and the remainder are Aultman-Taylor boilers having 3468 sq. ft. of heating surface and 90 sq. ft. of grate surface. Kentucky St. Bernard coal, composed of a mixture of pea and slack containing 13 per cent ash, is burned under these boilers. All are equipped with Babcock & Wilcox chain-grate stokers operated from a common line shaft supported beneath the floor and driven by a single motor. A 220-ft. stack having a maximum internal diameter of 9 ft. disposes of the combustion gases from the six boilers. A steam pressure of 210 lb. is maintained at a superheat of 100 deg. and the boiler feed-water temperature is about 212 deg. Fahr.

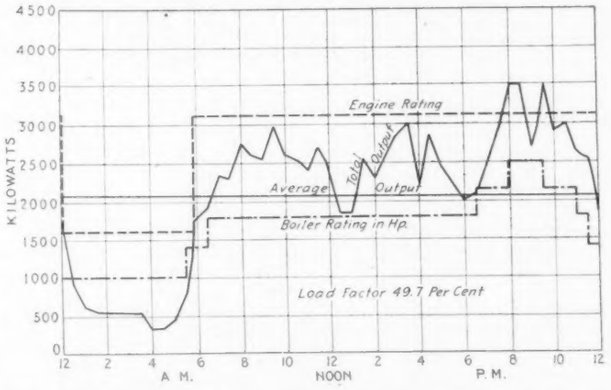


FIG. 4—COMBINED LOAD DIAGRAMS, DIVISION AND MULBERRY STREET STATIONS

The generating equipment consists of one 1500-kw Allis-Chalmers horizontal turbo-generator, one 1600-kw Westinghouse horizontal unit, one 1000-kw General Electric vertical unit and one 500-kw General Electric vertical unit. The two larger units are installed at the north end of the building, and both operate condensing. Cooling water for their surface condensers is pumped from six 12-in. wells, 102 ft. deep, located at intervals around the walls of the engine room. Two other 12-in. wells have been driven recently and the pumps are being installed. Each of the wells is capable of delivering 400 gal. of water per minute at a temperature of 58 deg. Fahr.

Because of the low temperature of the water obtained

from the deep wells it has been found practicable to circulate the condensing water through the two larger units in series. With a load of 2000 kw on each machine it is possible to obtain a vacuum of 27.5 in. on the machine which is the first to receive the water, while the vacuum in the other unit remains within 3 in. of that obtained in the first machine. The load is generally carried by the two larger machines, but when the demand exceeds 4000 kw the 1000-kw vertical unit is started. This machine also operates condensing, but its surface condenser is provided with water from one of the cooling towers outside the station.

The condensers of the two 2000-kw machines are connected by a 15-in. pipe equipped with a by-pass valve which permits of circulating the water through the condensers in parallel or in series. Worthington condensers having 5200 sq. ft. of cooling surface are used on each of the 2000-kw turbines, and a Wheeler condenser having 4200 sq. ft. of cooling surface is employed on the 1000-kw machine. The 500-kw vertical

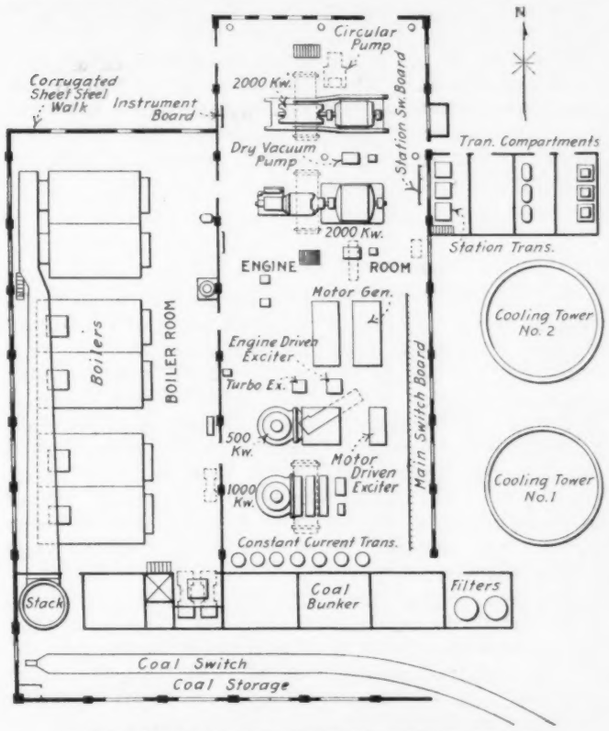


FIG. 5—PLAN OF DIVISION STREET PLANT

unit is provided with an 18-in. jet condenser. Water is supplied to the cooling towers by 14-in. centrifugal pumps which are capable of delivering 3600 gal. of water per minute against a head of 35 ft. These are installed in the basement of the station and are driven by 75-hp, 440-volt General Electric induction motors. Both of the cooling towers are of the Alberger type. The older one has been remodeled to meet better the requirements of the station.

Two 750-kw motor generators have been installed recently to furnish energy for the railway and interurban road. Energy to be delivered to the interurban line at distant points is transmitted over high-tension lines to substations.

As operated at present all of the generators in this station are delta-connected and are delivering energy at 2300 volts, but by joining the windings in star they will generate at 4100 volts, except those controlling railway-feeder circuits. Duplicate 2300-volt buses are installed in the basement on pipe-frame racks. The buses consist of copper tubes insulated with oiled cam-

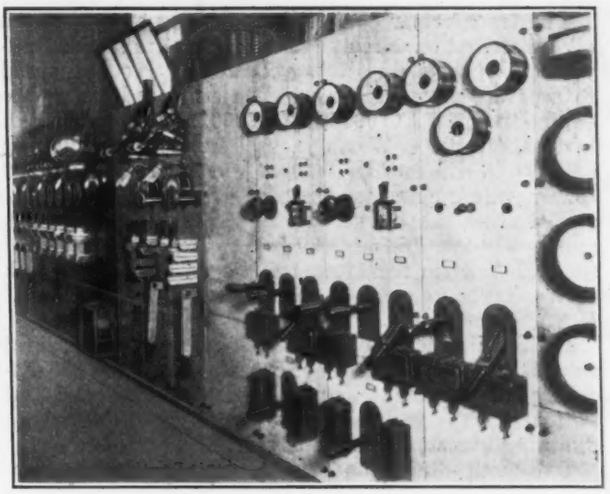


FIG. 6—PORTION OF MAIN SWITCHBOARD

bric and are supported on vertical pin-type insulators attached to horizontal pipes fastened to the vertical uprights. No disconnecting switches are used between the 2300-volt oil switches and the busbars. Current and potential transformers and oil switches also are supported on the same framework and all are easily accessible. The busbars are mounted on one side of the framework and the transformers and oil switches are on the opposite side.

Along the east wall of this generating room are the main and station switchboards. The main switchboard, which is about 90 in. high and 75 ft. long, controls all of the generating units, eight railway circuits and an equal number of commercial-feeder circuits. Each generator panel is provided with four oil-switch handles. One of these is the machine switch, and two are bus switches and are used to connect the machine onto one of the duplicate buses. The latter are interlocked so that it is impossible to close both at the same time.

The motor-generator sets, which furnish energy for the city railway and local interurban service, may be started from either the direct-current or the alternating-current side. Small induction motors on the shafts of the machines permit of starting from the three-phase station buses, while four-contact knife switches and grid resistors are employed for direct-current starting. The grids are supported on channel irons above the back of the switchboards.

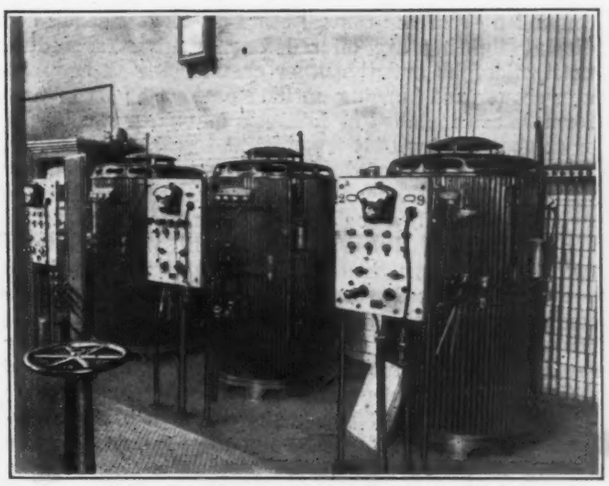


FIG. 7—CONSTANT-CURRENT TRANSFORMERS USED FOR STREET LIGHTING

The transformer equipment supplying energy to the city distribution circuits and to the Evansville Railways Company's lines is segregated in groups housed in separate compartments in the annex adjoining the engine room. A 1000-kva, 22,000/2300-volt bank of three single-phase Westinghouse transformers supplies energy to interurban substations at Princeton and Bower, where new high-tension apparatus has been installed since the merger of the Evansville companies, and a 330-kw, 13,200/2300-volt, three-unit bank of General Electric transformers and an equivalent bank of Westinghouse units furnish energy to substations at Mount Vernon and Newburg.

In the high-tension circuits of the two last-named substations are installed choke coils, "broomstick" disconnecting switches, multi-gap arresters and oil switches, while in the 22,000-volt circuit electrolytic lightning arresters are employed.

Two motor-circuit and six lamp-circuit feeders supply energy for city service. The heaviest feeder extends from the station west along Division Street, while the others radiate in different directions. Energy is distributed at 2300 volts, three-phase, and transformers are installed at intervals of about a block, insuring that no secondary circuit shall be longer than 125 ft. on the average. Tie switches are located at points where circuits pass near each other so that any section can be segregated or fed from several directions.

Street-Lighting Installation

In the business sections of the city the street-lighting circuits for incandescent ornamental illumination are laid in basements, while in outlying portions of the city they are inclosed in conduit run along the curbs or at the edge of sidewalks. About 543 General Electric series inclosed-arc lamps and 39 series tungsten lamps are installed. For these the city pays respectively $65 and $24 per year per lamp. Besides this equipment there are 132 five-lamp Luxalabra street fixtures, energy for which is paid for by the merchants at $5 per month. The lamps burn from dusk until midnight. Each fixture contains four 60-watt lamps and one 100-watt unit. The North Side business men contemplate installing thirty-six more posts on Main Street, arranged five to a block. When these are installed twenty blocks on that street will be illuminated by ornamental fixtures. Those now installed are about 60 ft. center to center.

Primary circuits supplying energy to electric signs are run through the alleys. Show-window lamps are connected to the same circuits as the signs and all are controlled from the central station. Two schedules of display lighting are offered, one burning from dusk until midnight and the other commencing thirty minutes sooner and burning until 11 p. m. The sign transformers are installed at intervals of one to two blocks, or so that a 5-kw unit is sufficient to carry the load.

The total output of the Evansville central station last year was 8,088,100 kw-hr. Energy was produced at the switchboard with a coal consumption of about 3.99 lb. per kw-hr. The Mulberry Street plant, which contains two 750-kw Westinghouse non-condensing turbines and one 1000-kw bleeder-type turbine made by the same company, supplies all of the steam used for district heating at present. About 125,000 sq. ft. of heating surface is now connected to the mains and is supplied with steam at 2 lb. pressure. Two rates are offered: One is a flat rate of 30 cents per sq. ft. of heating surface per heating season, and the other is based on the amount of steam consumed. Automatic thermostatic valves, which shut off the steam when the temperature reaches 70 deg. Fahr., are installed in the service feeders when a flat rate is charged.

The officers of the Evansville Public Service Company are: Mr. B. C. Cobb, chairman of the board of directors; Mr. A. C. Blinn, president; Mr. H. W. Marshall, vice-president; Mr. F. J. Haas, secretary; Mr. B. E. Parker, superintendent of railways; Mr. J. C. Silverthorn, general superintendent of the gas department; Mr. B. V. Bosard, superintendent of electrical distribution, and Mr. George Sloates, chief engineer. Mr. Cobb is chairman of the board of directors of the Public Utilities company, Mr. Marshall president, Mr. Blinn vice-president and Mr. Haas secretary. Mr. Blinn is also general manager of both companies.

Submarine Power Transmission from Sweden to Denmark

With the sanction of the Swedish and Danish governments, the South Swedish Power Company and the North Sjaeland Electric Works have entered into an agreement for the transmission of 15,000 electrical hp from the Laga River in Sweden under the Strait of Oresund by means of a submarine cable to the Danish island of Sjaeland. The point of crossing will be not far from the famous cape of Elsinore, where the scene of Shakespeare's "Hamlet" was laid. The cable will be four miles in length and will transmit energy for lighting the entire north part of Sjaeland.

The Cost of Pole Lines

The report of the Board of Public Utility Commissioners of New Jersey on the application of the Jersey Power Company to issue capital stock, which has been mentioned previously in the *Electrical World*, contains much information in regard to costs of pole line construction. The contract with the Hopatcong Mountain Lake Land Development Company for 516 poles showed the following prices: Six 70 ft. long at $18.50 each; ten of 65 ft. at $15 each; fifty of 60 ft. at $11.50; eighty of 55 ft. at $8.75; 120 of 50 ft. at $8; 250 of 45 ft. at $5.50. The average price was $7.50; the average height was 49 ft.

The cost of poles from Boonton to Millbrook, N. J., is figured by the commission at $2,660. This allows for 406 poles with a total of 19,250 ft., or an average of 47.3 ft. and an average price of $6.55 per pole. This estimate is based on an average number of forty-five poles per mile. The commission's engineer, Mr. H. E. Carver, testified that in his judgment $4.10 was an adequate price for setting a pole. The engineer for the company, Mr. Lowe, testified that the cost of stringing wire would average about $25 per mile of wire. The commission allowed $45 per mile for stringing wire from Millbrook to Dover owing to the conditions under which this wire must be strung.

In general, on the figures of the company the commission estimated the average price of poles delivered on the cars at $7.50 each. It allowed on the basis of the evidence $7.50 as the average cost for unloading, teaming, hauling, digging, locating, framing, setting and tree-trimming, including necessary guys and anchors for poles. The commission allowed for wire 5 per cent more than the estimate of the company inasmuch as the estimate allowed nothing for sag. For braces, insulators and cross-arms on poles the commission allowed only $7 between Boonton and Millbrook. To the total net cost of physical construction, as estimated, the commission added 13 per cent for engineering and contingencies. The testimony as to the cost of right-of-way showed an outlay of roughly $8,000 therefor.

Electricity Versus Steam in Drainage Pumping

Data on first cost and operating expenses of steam and motor-driven pumping stations used for draining agricultural lands along Illinois and Mississippi Rivers

MUCH has been said and written of the advantages of electric drive for pumping water onto arid land—electrical irrigation—but the reverse of this process, the removal of water from the lands in order that they may be cultivated—electrical drainage—is in some sections equally important. On the Mississippi and Illinois Rivers such drainage pumps must operate against a head ranging from zero to 21 ft. and must be able to cope with widely varying quantities of water. Records show, however, that the need for extreme lifts occurs only once in six or seven years and then extends over a period of probably not more than ten days. From records which have been kept in the Coal Creek district on the Illinois River, opposite Beardstown, Ill., the maximum lift exceeded 19 ft. in only two years out of thirteen, and thirty-one was the total number of days during which this lift was exceeded.

Lands comprising most of the drainage districts along the Illinois and Mississippi Rivers are considerably below the level of these streams during part or all of the year. Hence the only practicable method of bringing these lands under cultivation is that of building a levee system, digging ditches and canals and installing a pumping plant to remove the water to a level permitting the land to be farmed. Pumping plants in general have been installed at the lowest points of the district, near the river, the water being collected from the land through a series of streams, open ditches and canals leading into the main canal which terminates at the sump of the pumping plant.

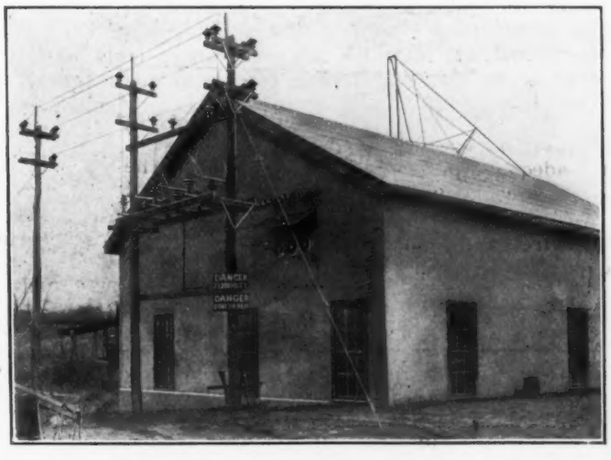


FIG. 1—PUMPING STATION, COAL CREEK DRAINAGE DISTRICT, OPPOSITE BEARDSTOWN, ILL.

As given by the Internal Improvement Commission of Illinois, the rainfall for the central part of the State is 35.34 in. However, the maximum rainfall along the Illinois River has been estimated at 41.5 in., and on account of the well-drained condition of the land the run-off has been placed at 31 per cent. Therefore the maximum amount of water to be pumped amounts to about 31 per cent of 41.5 in., or about 13 in. depth of water on each acre of watershed.

Most pumping stations now in use in these drainage districts are steam-driven and the majority comprise installations of fire-tube boilers and Corliss or four-valve engines, either belted or directly connected to centrifugal pumps. Usually such stations have two pumps, the relative capacities of which are one-third and two-thirds of the total rating of the station. Such a difference in sizes is advisable because of operating conditions which require heavy pumping for only about three months of the year. From 60 to 75 per cent of the total work is ordinarily done from March 15 to June 15, while the remaining 25 to 40 per cent is evenly distributed over the other nine months of the year. Since this condition is detrimental to economic operation of a steam plant, it is usual practice to allow the water to back up in the ditches and to pump down to a lower level only when water enough has been stored to justify starting the plant. This operating condition, it will be seen at once, is opposed, of course, to one of the first requirements of a drainage district. The water should at all times be kept at a desirable level in the main canal. In other plants where pumps are operated on each alternate day and boiler fires are banked between these periods about one-half as much coal is required to bank the fires as is actually needed to pump the water.

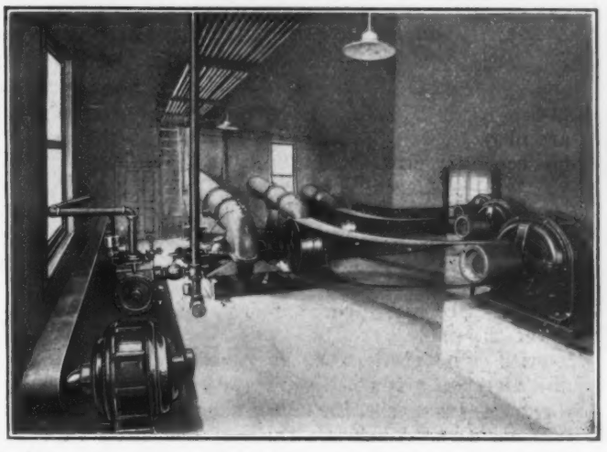


FIG. 2—THREE 2200-VOLT MOTORS DRIVING 22-IN. DOUBLE-SUCTION PUMPS

Cost of Steam Pumping Stations

The cost data in Table I have been collected from five steam pumping stations, ranging from 100 hp to 500 hp in rating, situated along the Illinois River between Beardstown and Eldred. In computing the fixed charges, interest has been taken at 6 per cent, taxes and insurance at 1 per cent and depreciation at 10 per cent, giving a total of 17 per cent for annual fixed charges on the original investment. Operating expenses, of which the principal items are coal, labor,

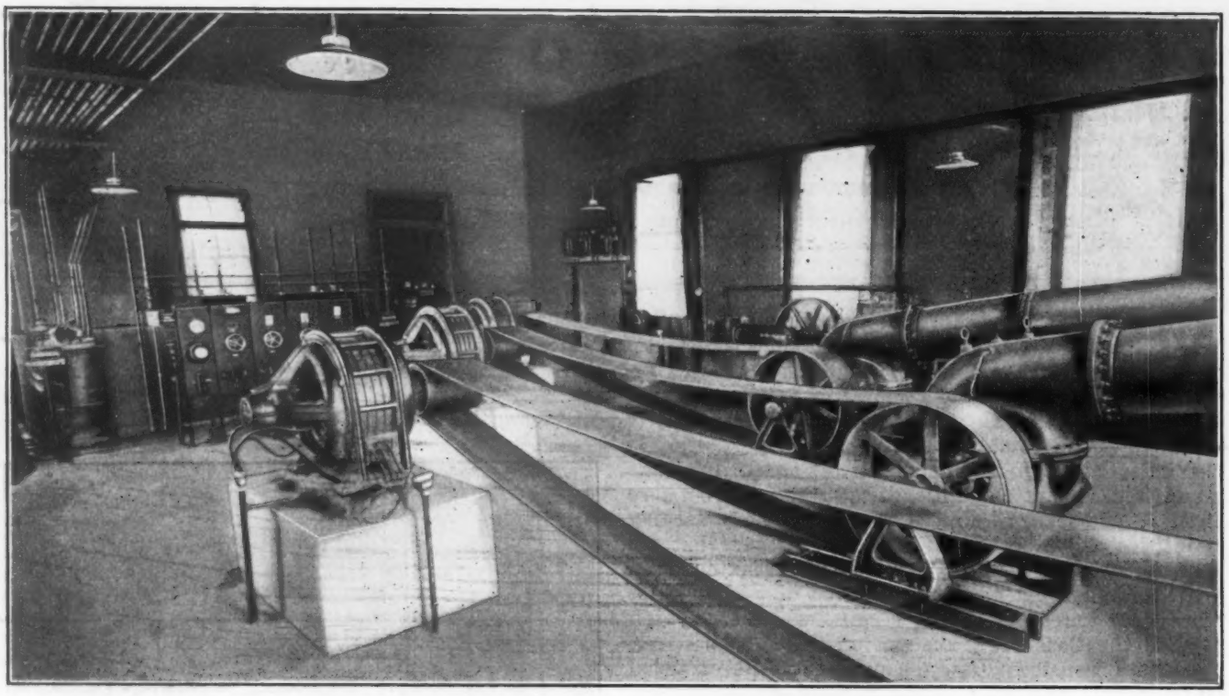


FIG. 3—INTERIOR VIEW OF PUMPING STATION

supplies and repairs, provide merely for the daily operation of the plant.

It will be noted that the average operating expense of the districts given is 75 cents a year an acre, while the average total cost, including fixed charges, is $1.38 a year an acre. Thus the ratio of operating expense to total cost is 53.6 per cent. It is also noteworthy that the lowest total cost given, namely $1.11 an acre per year, was obtained in a district with an average lift of less than 3 ft., showing that total expenses do not vary with the lift but that they are sensibly independent of the lift for average lifts not exceeding 10 ft. or 11 ft.

Eight Electrically Operated Plants

Recently data have been collected from eight electrically operated plants in Illinois (Table II), showing the costs of the installations as they were made and something of the principal characteristics of each station. The total area drained by these eight plants is 54,170 acres, so that the installations are large enough to give what may be considered a fair comparative figure. These data show that the cost of building a modern electric pumping station varies from 50 to 60 per cent of the cost of building a modern steam station to do the same work. The districts selected as examples are supplied with electrical energy from the transmission lines of several companies, and on account of the differences between operating conditions and owing to the fact that several district systems are not yet in operation it is not possible to present definite figures as to relative cost of operation. However, it has been established that the total cost of operating electric pumping stations for drainage district service is from 10 to 35 per cent less than the total cost of operating steam stations under the same conditions.

Solution of the Variable-Head Pumping Problem

In addition to these data on larger installations, it has been shown that the use of electrical energy makes available for drainage a large amount of land which it is impracticable to reclaim by use of steam power. A steam pumping station is efficient only when used for large districts in which the area ranges from 4000 to 5000 acres. It is interesting to note in this connection that one installation now in service on the Illinois River consists of a 20-hp motor driving an 8-in. centrifugal pump and drains a farm consisting of only 64 acres. The motor is operated by the owner of the farm, who lives on this tract, and it is needless to say that he could not economically operate a steam pumping station himself.

As has been said, the speed of the engines in the

TABLE I—COST DATA FOR FIVE STEAM PUMPING STATIONS

Name of District	Hp in Engines Installed	Initial Cost of Pumping Plant	Annual Fixed Charges	Annual Operating Expenses	Number of Acres in Watershed	Number of Acres in District	Operating Expense per Acre per Year	Total Cost per Acre per Year	Operating Ratio, per Cent
A	100	$7,000	$1,190	$2,200	2,160	2,160	$1.020	$1.57	65
B	275	30,000	5,100	8,412	11,000	11,000	0.765	1.23	62
C	500	50,000	8,500	5,966	16,000	13,000	0.459	1.11	41
D	250	25,000	4,250	5,400	7,420	6,800	0.795	1.42	56
E	325	35,000	5,950	4,700	7,420	6,800	0.690	1.57	44
Totals	1,450	$147,000	$24,990	$26,678	44,000	39,760	$3.729	$6.90	268
Average	290	29,500	4,998	5,336	8,800	7,952	0.746	1.38	53.6

steam pumping stations was varied as the head against which they were pumping varied, by the process of lengthening or shortening the cut-off. The method by

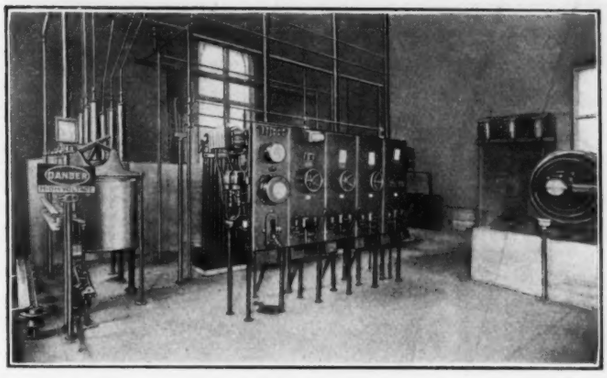


FIG. 4—SWITCHBOARD AND TRANSFORMERS

which alternating-current motors, which inherently operate at a constant speed, were made to meet this variable speed problem is interesting and instructive.

TABLE II—DATA ON ELECTRIC PUMPING STATIONS FOR DRAINAGE DISTRICTS

Number of District	Initial Cost of Electric Station	Initial Cost of Steam Station of Equal Capacity	Percentage of Cost of Electric Station to Cost of Steam Station	Horse-power of Motors Installed	ACREAGE		HORSE-POWER PER 1000 ACRES		NOMINAL CAPACITY OF PLANT		
					District	Water-shed	District	Water-shed	Total Gal. per Minute	Gal. per Minute per District	Acres Water-shed
1	$20,000	$35,000	57.1	300	6,700	7,426	44.8	40.4	36,000	5.37	4.85
2	16,000	29,000	55.2	200	3,270	4,300	61.2	46.5	24,000	7.34	5.58
3	10,000	20,000*	50.0	185	3,000	.....	61.7	.....	24,000	8.00	.....
4	21,000	37,000	56.7	250†	12,000	18,500	41.6	27.0	71,000	5.91	3.84
5	.....	.....	.....	100‡	12,000	15,000	33.3	26.7	60,000	5.00	4.00
6	.....	.....	.....	135	2,400	2,700	55.3	50.0	17,500	7.29	6.48
7	10,500	17,500*	60.0	125	800	.....	155.0	.....	15,000	18.75	.....
8	.....	.....	.....	450	14,000	.....	32.1	.....	66,000*	4.71	.....
Totals....	.....	.....	.....	1745	54,170	.....	.....	.....	313,500	.....	.....

*These figures are estimated from best available data.
†This electric station is used in conjunction with 250-hp steam station, making total of both stations 500 hp.
‡This electric station is used in conjunction with 300-hp steam station, making total of both stations 400 hp.

Taking, for instance, the Big Swan Levee and Drainage District, a typical installation, from which a 24-in. Worthington centrifugal pump normally removes 14,000 gal. of water a minute during average operation, the changes which were necessary to install successful motor drive can be shown. Formerly, the pump here was driven at speeds varying from 150 r.p.m. to 215 r.p.m. by a steam engine on the foundation shown in Fig. 3. Afterward, however, this unit was replaced by a 100-hp, 585 r.p.m., 2300-volt, three-phase, slip-ring induction motor, mounted on an extension of the former engine foundation. The motor was then connected through gears, a silent chain and a flexible coupling to the pump, which had been left in its former position.

Three Gears, Three Speeds

By selecting three separate motor pinions to be fitted to the shaft as the head changes against which the pump must work, it is possible to operate the pump itself at 215 r.p.m. or 185 r.p.m. or 150 r.p.m. The lowest speed, 150 r.p.m., is used when the pump is working against a lift of from zero to 7 ft. The second speed is used for operation against lifts varying from 7 ft. to 14 ft., and the third speed, 215 r.p.m., when the lift reaches from 14 ft. to 20 ft. By this ingenious arrangement the pump and the motor both work at high efficiency at all times. Tests have shown that the set never falls more than 5 per cent below its highest possible efficiency. As the motor is always fully loaded, its operation is at approximately 80 per cent power-factor.

In sharp contrast to the time required to start up a steam plant stands out the fact that only two and one-half minutes are required to place an electric station in operation. This, however, is a record, and fifteen minutes is given as the usual time for starting a motor-driven plant.

Terms of Pumping Contract

According to the terms of the contract between the Big Swan Levee and Drainage District and the Central Illinois Public Service Company, from which energy is purchased, the pumping station is not operated during the three hours of the day over which the electric service company's system peak extends. Apparatus for indoor-type 2300-volt substation is furnished by the electric-service company, but the low-voltage apparatus for lighting and for driving the small air pumps in the plant is owned by the drainage district. Free right-of-way is also granted to the electric-service company on any part of the land owned by the operators of the drainage district.

Cost of Developing Low Land

The initial outlay in certain levee districts operating some of the most successful areas has averaged as low as $30 per acre, while the same improvements for some other districts now being put in operation have cost over $50 per acre. In view of these higher first costs of development, attention is rapidly being turned toward electrical drainage. With electrically operated stations, it is no longer necessary to concentrate the pumping equipment at one point, but shorter ditches and levees may be dug and the pumping equipment divided into several parts where the construction of a single drainage system would be prohibitive.

The data on first cost and operating expenses of pumping stations presented in this article were collected by Mr. J. Paul Clayton, manager of the commercial department of the Central Illinois Public Service Company, which has been active in encouraging the establishment of electrically operated stations. Most of the figures concerning rainfall were secured from the records of the drainage districts themselves.

Resonance Tests of Long Transmission Line

Experimental investigation of the voltage rise on an artificial 240-mile line with frequency of 189 cycles per second. By A. E. Kennelly and Harold Pender

IT is well known that a long aerial energy transmission line connected to a polyphase generator at one end A and freed at the distant end B tends to maintain a higher voltage at B than at A, a condition commonly called the Ferranti effect from its having first been reported by Ferranti in 1890. The voltage ratio E_b/E_a may be called the Ferranti ratio or Ferranti factor of the line. This ratio is known to attain its maximum value for a given uniform line, operated at a given single frequency, when the line has such a length as to develop a quarter wave-length in the distance AB, so that the line becomes a quarter-wave line. This quarter-wave maximum Ferranti effect is sometimes described as electrical resonance between the inductance and capacity of the line.

At energy-transmission frequencies not exceeding sixty cycles per second, the quarter-wave length of line is so great that it is not approached on the longest transmission line in service; but the higher the impressed frequency the shorter the quarter wave-length, so that some harmonic present in a generator voltage wave may readily develop quarter-wave resonance on actual lengths of energy-transmission line. The Ferranti factor of a long energy-transmission line may therefore be only, say, 1.05 to the fundamental frequency of operation, but a relatively small high frequency ripple in the wave of generated voltage may raise this factor to 1.3 or more. It is, therefore, important to determine how large the Ferranti factor may become to frequencies which may present themselves as harmonic ripples in the voltage wave of a generator. The measurements here reported throw light upon this subject from the experimental standpoint. Hitherto, so far as the writers are aware, the data available have been theoretical only.[1]

The measurements were made by the writers upon part of an artificial energy-transmission line installed in the research laboratory of the Massachusetts Institute of Technology and designed by Dr. Harold Pender and Mr. R. Huxley to imitate a three-phase aerial transmission line consisting of three copper-stranded conductors each of 500,000 circ. mils, spaced interaxially 9 ft. (275 cm). Such a line has been proposed to carry energy from the Victoria Falls to Johannesburg; so that, although the cross-section of copper is fairly large, it represents a line well within the limits of practical serviceability. This artificial line was recently illustrated and briefly described in the *Electrical World*.[2] It is a Π line; that is, a line composed of Π-sections, or series non-ferric inductance coils with condensers tapped to ground from the junction points. Each section corresponds to 30 miles (48 km) of line conductor, and eight sections were used, representing a line 240 miles (386 km) as one conductor of a three-phase transmission system of that length. It was found by experiment that this length of artificial line was in quarter-wave resonance under an impressed frequency of 189 cycles per second. This would be a triple-frequency harmonic in a generator giving sixty-three cycles per second, and a quintuple-frequency harmonic in a generator of 37.8 cycles. The lumpiness error of the line at 189 cycles is less than one-fifth of 1 per cent; so that the artificial line with its lumped inductances and condensances behaves just like the corresponding line of distributed inductances and condensances, within the limits of observation.

Generator.—The generator employed for impressing the 189-cycle frequency was a concatenated induction machine driven above synchronism by a direct-current motor. The oscillographed wave-form of the emf produced by this generator is shown by the triple-frequency curve in Fig. 1, the other curve being that of the voltage impressed on the stator of the first motor. The frequency of the generator was kept as nearly as possible constant during the tests.

Electrical Connections.—The connections of the sections with the generator and measuring instruments are indicated in Fig. 2. G is the induction-generator connected to the line through an alternating-current ammeter, a, the impressed emf, being measured by an alternating-current voltmeter V. The conductor NN corresponds to ground return or the neutral of a balanced three-phase system.

The potential was measured at the free end B, and at intermediate junctions 1, 2 and 3, by means of an electrostatic voltmeter. Between A and junction 4 inclusive it was measured by an alternating-current voltmeter and multiplier. This instrument acted as a slight leak on the line, and the values of potential so observed had to be slightly corrected for this leak except at the end A.

Voltages Observed at Resonant Frequency.—Fig. 3 shows the voltages observed along the artificial line. The black dots mark the observations, and the curve is drawn through the corresponding computed values. It will be seen that the observations are in satisfactory agreement with the theoretically deduced values. With 51.5 volts impressed on the sending end A of the line, the voltage observed at the distant free end B was 1033, representing a Ferranti factor of $1033 \div 51.5 = 20.06$. This means that at the particular frequency of 189 cycles the voltage at the distant free end of this particular length and character of line conductor would be twenty times the voltage impressed at the sending end. In a corresponding three-phase aerial line system, if 1000 volts at 189 cycles were impressed at the generating end between any pair of the three line conductors, the voltage between the open ends of the same conductors, 240 miles (386 km) away, would be 20,060 volts. If, however, the impressed voltage were, say, 100 kv, the distant free-end voltage could not of course be expected to reach 2000 kv, because the insulators of the line could not be expected to withstand such a pressure, and the effect of corona losses might be expected to reduce the Ferranti factor long before the insulators broke down. Up to the limits permitted by insulation, however, or of extra losses in the dielectric, such as corona losses, the Ferranti factor of 20 would be ex-

[1] "The Influence of Frequency on the Equivalent Circuits of Alternating-Current Transmission Lines," by A. E. Kennelly, *Electrical World*, Jan. 21, 1909.

[2] "Design for Artificial Transmission Line," *Electrical World*, May 2, 1914, page 980.

pected to apply to this length of line of uniform line constants at this quarter-wave frequency or resonant frequency.

Currents Observed at Resonant Frequency.—The current at the generating end A in the test with the distant end free was 2.99 amp, which at 51.5 volts gives 154 volt-amp.

The active power at A was 154 watts, indicating that the current entering the line was substantially in phase with the impressed voltage. The current along the line was not measured. It would of course diminish to zero at the distant open end B, according to a hyperbolic sine law.

When the line was grounded at the far end B, keeping the frequency constant at 189 cycles, the condition changed from quarter-wave voltage resonance to quarter-wave current resonance. That is, the current passing to ground at B became twenty times as large as the current entering the line at A. In order to be able to measure the currents with greater precision, the impressed emf at A was raised to 805 volts, when the A current was observed to be 0.116 amp with an active power of 85 watts. Coincidently, the current at B was observed to be 2.32 amp, under zero voltage.

Theory.—Tests were made of the coils composing the artificial line at the resonant frequency (189 cycles) used in the test. These coils were found to be in electrical agreement within about 1 per cent. They were constructed at the Institute so as to form approximate closed circular solenoids. The condensers were

TABLE I—CONSTANTS FOR A SINGLE Π-SECTION OF ARTIFICIAL LINE AT 189 CYCLES PER SECOND

	Per Section	Per Wire-Mile	Per Wire-Km
Resistance of coil at 25 deg. C.	R, 3.83 ohms	0.1277	0.0793
Inductance of coil at 25 deg. C.	L, 0.0557 henry	0.001857	0.001154
Capacitance of section condenser	C, 0.485 microfarad	0.01617	0.01004
Leakance of section condenser	G, 3.2 micromho	0.1067	0.0663

made of paper and foil by the Western Electric Company and were specially selected with regard to uniformity and low power-factor when tested over a considerable range in frequency. The particulars for a single section are given in Table I. The stated tests on the coils were made at the test frequency f of 189.4 cycles per second.

Calculation by Simple Trigonometry[3].—The current I_o, voltage to neutral V_o and power-factor angle φ_o (taken positive for lagging current) at any point on a line at a distance of l miles from the load are given by the following expressions, all angles being in degrees,

$$I_o = \sqrt{A_o^2 + B_o^2 + 2AB\cos(114.6\,\beta l + \theta)},$$

$$V_o = \frac{1}{Y}\sqrt{A^2_o + B^2_o + 2AB\cos(114.6\,\beta l + \theta)},$$

$$\varphi = \tan^{-1}\left[\frac{2AB\sin(114.6\,\beta l + \theta)}{A_o^2 - B_o^2}\right] - \psi$$

Note that the quadrant in which $(\varphi_o + \psi)$ lies is determined by the algebraic signs of the numerator and denominator of the fraction in the brackets.

The various quantities in these equations have the following values:

I, V and φ = the current, voltage to neutral and power-factor angle at the load.

f = frequency in cycles per second.

r = conductor resistance per mile, in ohms.

$x = 2\pi fL$ = conductor reactance per mile in ohms, corresponding to the impressed frequency f and inductance L.

$z = \sqrt{r^2 + x^2}$ = conductor impedance per mile, in ohms.

g = leakage conductance to neutral per mile of line, in micromhos.

$b = 2\pi fC$ = capacity susceptance to neutral per mile of line, in micromhos, corresponding to the impressed frequency f and capacity to neutral C.

$y = \sqrt{g^2 + b^2}$ = dielectric admittance per mile, in micromhos; for $g = 0$, $y = b$.

$$\alpha = 10^{-3}\sqrt{\frac{yz - bx + gr}{2}},\quad \beta = 10^{-3}\sqrt{\frac{yz + bx - gr}{2}}$$

$$Y = 10^{-3}\sqrt{\frac{y}{z}},\quad \psi = \tan^{-1}\left[\frac{yz - bx - gr}{yz + bx + gr}\right]$$

Note that ψ is taken positive for $gx < br$ and negative for $gx > br$.

$$A = \frac{1}{2}\sqrt{I^2 + (YV)^2 + 2YVI\cos(\varphi + \psi)}.$$

$$B = \frac{1}{2}\sqrt{I^2 + (YV)^2 - 2YVI\cos(\varphi + \psi)}.$$

$$\theta = \tan^{-1}\left[\frac{2YVI\sin(\varphi + \psi)}{I^2 - (YV)^2}\right].$$

Note that $\sin\theta$ has the same algebraic sign as the numerator of this fraction and $\cos\theta$ has the same algebraic sign as the denominator of this fraction; this fixes the quadrant in which θ lies.

$$A_o = A_o E^{\alpha l} \text{ and } B_o = \frac{B}{E^{\alpha l}}$$

Note also that the velocity of propagation is

$$U = \frac{2\pi f}{\beta} \text{ miles per second}$$

and the wave length of the waves set up is

$$\lambda = \frac{2\pi}{\beta} = \frac{U}{f}.$$

When $\frac{r}{x}$ and $\frac{g}{b}$ are small compared with unity (each less than 0.1), then, with an error of less than 0.5 per cent,

$$\alpha = \frac{10^{-3}}{2}\left(r\sqrt{\frac{C}{L}} + g\sqrt{\frac{L}{C}}\right)\text{deg.}$$

$$\psi = \frac{4.57}{f}\left(\frac{r}{L} - \frac{g}{C}\right)\text{deg.}$$

When $\frac{r}{x}$ and $\frac{g}{x}$ are less than 0.1, these formulas will be found more convenient for slide-rule calculation than those given above.

It is to be noted that in general $\varepsilon^x = 0.4343 \times$ (the number whose common logarithm is x), where x is any number. For x less than 0.1, then $\varepsilon^x = 1 + x + \frac{x^2}{2}$, with an error of less than 0.5 per cent. Whence all the calculations may be effected with a slide rule.

It is also to be noted that when $A = B$ and $114.6\,\beta l = 180$ deg. (180 deg. being the value of this angle at the generator end of an exact quarter wave-length line), then $V_o = V\left(\frac{E^{\alpha l} - E^{-\alpha l}}{2}\right) = V\alpha l$, when αl is less than 0.1.

In the case of the artificial line under consideration, assuming no error due to lumpiness (which is justified

[3]See article on transmission lines in "American Handbook for Electrical Engineers" (Wiley & Sons, New York, 1914).

as shown below), the various constants are as follows: $I = 0$, $V = 1033$, $f = 189.4$, $r = 0.1277$, $L = 0.001857$, $x = 2.21$, $z = 2.24$, $g = 0.1067$, $C = 0.01617$, $b = 19.2$, $y = 19.2$, $\alpha = 0.000206$, $\beta = 0.00655$, $Y = 0.00293$, $\psi = 1.5°$, $A = B = 1.515$, $\theta = 180°$, $U = 181{,}400$, $\lambda = 958$, and a quarter wave-length is then $958/4 = 239.5$ miles, which checks well with the 240 miles actually used. The calculated voltages at the various junction points are then as given in Table II, the observed values being also given for comparison.

TABLE II—VOLTAGES AT JUNCTION POINTS

Junction	Miles from Load End	Calculated Voltage	Observed Voltage
Load end	0	1033	1033
1	30	1013	1015
2	60	957	960
3	90	861	860
4	120	734	735
5	150	575	559
6	180	398	397
7	210	207	211
Generator end	240	51.2	51.5

Calculations in Terms of Hyperbolic Functions.—The angular velocity corresponding to the frequency of 189.4 cycles per second is $\omega = 2\pi f = 6.283 \times 189.4 = 1190$ radians per second. At this angular velocity the section coil-reactance $jX = jL\omega = j\,66.28$ ohms, and the section condenser susceptance $jc\omega$ $j\,577.2 \times 10^{-6}$ mho. The section impedance was, therefore, $Z_s = 3.83 + j\,66.28$ ohms $= 66.53\ \underline{|86°.7}$, and the section admittance $Y_s = (3.2 + j\,577.2)\ 10^{-6}$ mho $= 577.2 \times 10^{-6}\ \underline{|89°.7}$. The apparent angle subtended by a single section of the line at this frequency—i.e., the angle uncorrected for lumpiness—was:

$$\theta_s'' = \sqrt{Z_s Y_s} = \sqrt{66.53\ \underline{|86°.7} \times 577.2 \times 10^{-6}\ \underline{|89°.7}} = \sqrt{0.0384\ \underline{|176°.4}} = 0.1960\ \underline{|88°.2}\ \text{hyp.}$$

The lumpiness correction is expressed by the formula[4].

$$\text{Sinh}\ \frac{\theta_s}{2} = \frac{\theta_s''}{2} = 0.0980\ \underline{|88°.2}$$

From which, by tables, $\dfrac{\theta_s}{2} = 0.0980\ \underline{|88°.2} \times 1.002\ \underline{|0°.01} = 0.09820\ \underline{|88°.2}$ hyp, or $\theta_s = 0.1964\ \underline{|88°.2}$ hyp.

That is, the correcting factor for the lumpiness of the line was $1.002\ \underline{|0°.01}$, or only an increase of two-tenths of 1 per cent, a quantity too small to be measured with certainty. The artificial line behaved, therefore, to this frequency of 189 cycles substantially as though the capacitance were uniformly distributed. The angle subtended by the whole line of eight sections was therefore,

$$\theta_L = 8\,\theta_s = 1.5712\ \underline{|88°.2}\ \text{hyps.}$$
$$= 0.0493 + j\ 1.5706\ \text{hyps.}$$

The j component of the angle subtended by a quarter-wave line is $\dfrac{\pi}{2}$, or 1.5708 circular radians; so that the measured constants agree very well with the computed values for the observed resonant frequency of 189.4 cycles per second.

The voltage E_b at the distant free end of a line whose angle is θ_L, supplied with a voltage E_a at the generating end is

$$E_b = \frac{E_a}{\cosh \theta_L}\ \text{volts.}$$

In this case $\cosh \theta_L = \cosh\ (0.0493 + j\,1.5706) = j\,0.04932$; so that

$$E_b = \frac{E_a}{j\,0.04932} = -j\,20.27E_a = 20.27E_a\ \underline{|90°}\ \text{volts.}$$

The Ferranti factor is therefore 20.27 by computation from the line constants, while the observed value was 20.06, or about 1 per cent less. Table III gives the successive observed and computed voltages at the section junctions. In the table the values of the cosines in the third column have been taken from the chart[5] by direct inspection.

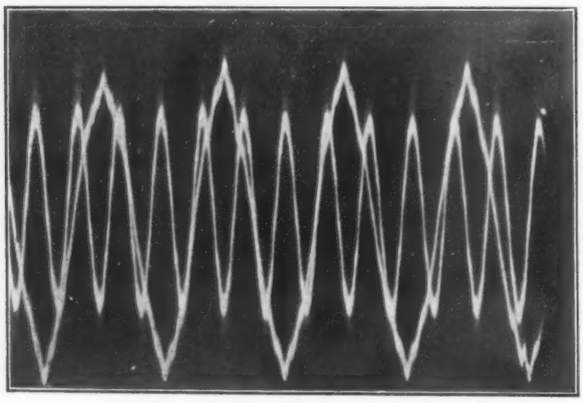


FIG. 1—OSCILLOGRAM OF EMF WAVE IMPRESSED ON ARTIFICIAL LINE

TABLE III—VOLTAGES AT SECTION JUNCTIONS

Junction	Angle δ from B	Cosh δ by Chart	Voltage	
			Computed	Observed
B	0	$1.000\ \underline{\|0.°}$	$1044\ \underline{\|90°}$	1033
1	$0.1964\ \underline{\|88.2}$	$0.98\ \underline{\|0.°10}$	$1023\ \underline{\|89.°9}$	1015
2	$0.393\ \underline{\|88.2}$	$0.924\ \underline{\|0.°25}$	$965\ \underline{\|89.°75}$	960
3	$0.589\ \underline{\|88.2}$	$0.832\ \underline{\|0.°75}$	$869\ \underline{\|89.°25}$	860
4	$0.786\ \underline{\|88.2}$	$0.708\ \underline{\|1.°3}$	$739\ \underline{\|88.°7}$	735
5	$0.982\ \underline{\|88.2}$	$0.555\ \underline{\|2.°7}$	$579\ \underline{\|87.°3}$	559
6	$1.178\ \underline{\|88.2}$	$0.383\ \underline{\|5.°3}$	$400\ \underline{\|84.°7}$	397
7	$1.375\ \underline{\|88.2}$	$0.200\ \underline{\|11.°5}$	$209\ \underline{\|78.5}$	211
A	$1.571\ \underline{\|88.2}$	$0.0493\ \underline{\|90°}$	$51.5\ \underline{\|0°}$	$51.5\ \underline{\|0°}$

The apparent surge impedance of a line-section, uncorrected for lumpiness, is

$$z''_0 = \sqrt{\frac{Z_s}{Y_s}} = \sqrt{\frac{66.53\ \underline{|86°.7}}{577.2 \times 10^{-6}\ \underline{|89°.7}}}$$

$$= \sqrt{115{,}300\ \underline{|3_0.0}} = 339.6\ \underline{|1°.5}\ \text{ohms.}$$

The lumpiness correcting-factor for a Π line is

$$\frac{1}{\cosh \frac{\theta_s}{2}} = \frac{1}{\cosh 0.0982\ \underline{|88°.2}} = \frac{1}{0.995\ \underline{|0°.02}};$$

so that the corrected surge impedance of the artificial line was

[4] "The Application of Hyperbolic Functions to Electrical Engineering Problems," by A. E. Kennelly, Chapter III, University of London Press.

[5] "Chart Atlas of Complex Hyperbolic and Circular Functions," Chart II, by A. E. Kennelly. Harvard University Press.

$$Z_o = \frac{339.6\ \underline{|1°.5}}{0.995\ \underline{|0°.02}} = 341.3\ \underline{|1°.5}\ \text{ohms.}$$

The impedance which the line should offer at the generating end when freed at the distant end is

$$Z_o/\tanh\theta_L = \frac{341.3\ \underline{|1°.5}}{\tanh\left(0.0493 + j\frac{\pi}{2}\right)} = \frac{341.3\ \underline{|1°.5}}{20.30\ \underline{|0°}}$$
$$= 16.81\ \underline{|1°.5}\ \text{ohms.}$$

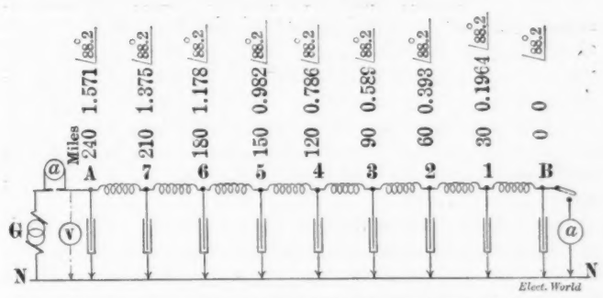


FIG. 2—DIAGRAM OF CONNECTIONS OF ARTIFICIAL LINE

Under an impressed emf of 51.5 $\underline{|0°}$ volts, the line should take

$$\frac{51.5\ \underline{|0°}}{16.81\ \underline{|1°.5}} = 3.064\ \underline{|1°.5}\ \text{amp.}$$

This current entering the line would carry a power of $51.5\ \underline{|0°} \times 3.064\ \underline{|1°.5} = 157.8\ \underline{|1°.5}$ volt-amp, or 157.7 active watts. The observed values were 2.99 amp and 154 active watts.

Similarly, with the line shorted or connected to neutral ground potential at the distant end, the sending-end impedance should be

$$Z_o \tanh\theta_L = 341.3\ \underline{|1°.5} \times \tanh\left(0.0493 + j\frac{\pi}{2}\right)$$
$$= 341.3\ \underline{|1°.5} \times 20.30\ \underline{|0°} = 6928\ \underline{|1°.5};$$

so that under an impressed emf of 805 $\underline{|0°}$ volts, the entering current should be

$$\frac{805\ \underline{|0°}}{6928\ \underline{|1°.5}} = 0.1162\ \underline{|1°.5}\ \text{amp,}$$

carrying a power of $805\ \underline{|0°} \times 0.1162\ \underline{|1°.5} = 93.54\ \underline{|1°.5}$ volt-amp, or 93.48 active watts. The observed values were 0.116 amp and 85 watts, the latter being read at an insensitive part of the wattmeter scale.

The agreement between the observed and computed values of voltage current and power was, therefore, fairly satisfactory.

Reductions from the Test Relating to Transmission-Line Voltage Regulation.—The tests above outlined indicate that a relatively small harmonic ripple of the generator-voltage fundamental sine wave may produce a very marked rise of pressure at the distant end of a fairly long power-transmission line when working at light load. Thus, in the case imitated on the artificial line here described, if a 5 per cent triple-harmonic frequency of 189.4 cycles were associated with a 100 per cent fundamental frequency of 63.1 cycles in the voltage at the generating end, the combined root-mean-square voltage at that end would be $\sqrt{100^2 + 5^2} = 100.5$, and the maximum possible peak voltage $105\sqrt{2}$. The fundamental frequency voltage at the distant free end would be 114.7, while the triple-frequency voltage would be $5 \times 20.06 = 100.3$. The combined root-mean-square voltage at the free end would thus reach $\sqrt{(114.7)^2 + (100.3)^2} = 152.4$, while the maximum possible peak voltage would be $215\sqrt{2}$.

As the length of the transmission line is diminished the frequency which will be necessary to excite quarter-wave resonance correspondingly increases, approximately according to the relation $f = \frac{75{,}000}{L}$ cycles per second, where L is the length of the transmission line in kilometers. Thus a 75-km aerial line (46.6 miles) would develop quarter-wave resonance at approximately 1000 cycles per second.

The Ferranti factor tends to increase somewhat with the frequency, except for the influence of skin effect on the impedance, which opposes the increase. Consequently, the Ferranti factor is of the same order of magnitude over a wide range of frequency. The shorter the transmission line, the higher the frequency that is therefore required to excite quarter-wave resonance. Whereas on a 386-km (240-mile) line only a triple harmonic of sixty-cycle fundamental voltage would suffice, on a 60-km (37.3-mile) line a frequency of about 1250, or about the seventeenth harmonic of the same fundamental voltage, would be necessary. It is thus quite possible to produce distinct resonant rise of voltage at the distant end of a comparatively short transmission line under light load, owing to the presence of an appreciable tooth-frequency harmonic happening to find the line at or near quarter-wave length.

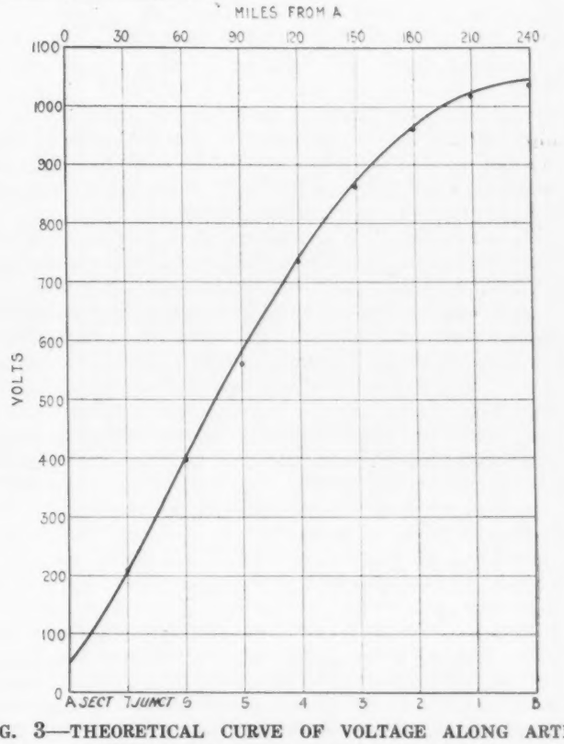


FIG. 3—THEORETICAL CURVE OF VOLTAGE ALONG ARTIFICIAL LINE AND OBSERVED VALUES

In conclusion, the authors recommend an artificial transmission line[6] as a valuable and by no means ex-

[6] J. H. Cunningham, "Design, Construction and Test of an Artificial Transmission Line," *Proc. Am. Inst. El. Engrs.*, Jan., 1911, Vol. XXX. A. E. Kennelly and H. Tabossi, "Artificial Power-Transmission Line," *Electrical World*, New York, Feb. 17, 1912. A. E. Kennelly and F. W. Lieberknecht, "Measurements of Voltage and Power Over a Long Artificial Power Transmission Line at Twenty-five and Sixty Cycles per Second," *Proc. Am. Inst. El. Engrs.*, June 25, 1912. A. E. Kennelly, "An Investigation of Transmission-Line Phenomena by Means of Hyperbolic Functions: The Distribution of Voltage and Current Over Il-Artificial Lines in the Steady State," *Electrical World*, New York, Aug. 10, 1912. A. E. Kennelly, "A Convenient Form of Continuous-Current Artificial Line," *Electrical World*, June 14, 1913.

pensive equipment of an electrotechnical laboratory.

Summary.—The Ferranti factor, or ratio of rise of potential, was measured experimentally by the writers on a large-copper artificial power-transmission line, representing 240 miles (386 km), at the Massachusetts Institute of Technology, with a frequency of 189 cycles per second. The ratio was found to be 20.06 and was in satisfactory accordance with the theory. This theory, which is essentially hyperbolic, is given both in the hyperbolic form and reduced to corresponding circular terms. The importance of harmonic frequencies contributing to the Ferranti ratio of long transmission lines by happening to excite quarter-wave resonance is pointed out.

Technical Topics at Ohio E. L. A. Convention

The general features of the convention of the Ohio Electric Light Association, held at Cedar Point, Ohio, July 21 to 24, were reported in the preceding issue, beginning on page 218. Herewith we present abstracts of the reports of the committees on illumination, meters and transmission, together with accounts of the several discussions.

Recommendations of Illumination Committee

In the report of the illumination committee, of which Mr. S. E. Doane, Cleveland, was chairman, four broad problems, thought particularly to merit the attention of the association in connection with its lighting service, were discussed. Two of these topics, namely, securing small customers to be found within easy reach of existing lines, and lighting country roads between cities and towns, referred to the extension of electric service into new fields. The other two topics, viz., the improvement in the efficiency of certain sizes of tungsten lamps, and the adoption of 120 volts as a standard potential, dealt more particularly with the development and progress of the existing industry.

The arc lamp as it has been known is passing and is being superseded by high-efficiency tungsten units, said Mr. Doane in opening the discussion of the committee's report. Care, however, should be exercised that central-station men realize just what change in the cost of lighting, especially street lighting, the new high-efficiency lamps will make. Considering that the cost of the energy for street lighting is but 10 per cent of the total cost, prices for street lighting should certainly not be reduced in proportion to the gain in lamp efficiency. In this connection Mr. Doane urged member companies to contend strenuously for street-lighting contracts on the candle-power basis instead of on the basis of energy consumed. In reply to a question Mr. Doane recommended the use of large-current gas-filled lamps, especially those operating at 6.6 amp.

Others who took part in the discussion were Messrs. W. R. Power, Huntington, W. Va.; Henry Schroeder, New York City; W. S. Culver, Cincinnati; F. B. Steele, Dayton; Thomas F. Kelly, Dayton; L. C. Anderson, Franklin; J. C. Martin, Wilmington, and O. H. Hutchings, Dayton.

Standardization of distribution potential at 120 volts, as recommended by the committee, was another of the principal topics under discussion, and inasmuch as this step promised reduction in lamp prices, the recommendation seemed to meet with popular favor. Although it was considered impracticable for all central stations to attempt operation at 120 volts immediately, it was suggested that three potentials, say, 104 volts, 112 volts and 120 volts, be adopted as standards and that each company strive toward a higher potential. A committee was appointed to consider standardization.

Regarding the committee's recommendation that member companies attempt the lighting of country roads, Mr. F. B. Steele read a written discussion by Mr. Thomas F. Kelly, Dayton, in which he reported that the Dayton Power & Light Company has already entered this field with considerable success.

Report of Meter Committee

Presenting the report of the meter committee, Mr. A. H. Bryant, Cleveland, chairman, told briefly of the three general conferences held during the past year at Cleveland, Toledo and Columbus. The committee recommended the continuance of these general conferences, the extension to three years of the terms of service of members of the meter committee, the appropriation of money to defray the expenses for a traveling representative of the meter committee who would be expected to visit member companies and to submit a confidential report, and the acceptance of a standard meter-report form.

Opening the discussion, Mr. A. A. Bryant, Cleveland, laid particular stress upon the recommendations to the effect that public meetings of the committee be held during the ensuing year, that money be appropriated for the expenses of a traveling meter-man to help small companies, and that a standard form of report be adopted. In the discussion the following spoke: Messrs. J. C. Martin, Wilmington; Prof. F. C. Caldwell, Columbus; G. E. Snider, Toledo; S. E. Doane, Cleveland; F. H. Krauss, Bellefontaine; D. L. Gaskill, Greenville; John K. Himes, Dayton; O. K. Hutchings, Dayton; W. Parsons, Springfield, and W. S. Culver, Cincinnati.

Report on Electrical Transmission

Keeping pace with the advance in high-tension work, the electrical transmission committee, of which Mr. M. H. Wagner was chairman, reported that in its belief 6600-volt distribution has passed the experimental stage and is now so generally used that it should no longer be classed as high-tension. Therefore, the committee recommended that overhead-line specifications for this type of construction be revised and made less stringent than the requirements of the National Electric Light Association.

The recommendations of the committee on electrical transmission caused a rather lengthy discussion covering several features of the report of the National Electric Light Association committee on overhead-line construction. Although opinions varied somewhat, it was generally conceded that there should be standard rules for line construction, and the hope was expressed that the joint report of the United States Bureau of Standards and the National Electric Light Association overhead construction committee, to be published in the fall, would afford just specifications.

Speaking of the practical side of line construction, Mr. D. L. Gaskill, Greenville, summed up the results of his experience in building 85 miles of transmission line in the following advice: Don't allow any trees within possible reaching distance of power lines; use the public highway for right-of-way when possible; for private right-of-way be willing to pay from $1 to $2 a pole; buy the best lightning protection there is—it is poor enough; single-phase, 33,000-volt lines with 30-ft. poles and No. 4 wire should be built for $1,000 a mile, and similar three-phase lines with transformers for $2,000 a mile; 6600-volt construction ought not to cost over $700 a mile; in using wooden cross-arms buy them large enough—4-in. by 5-in. fir arms are used at Greenville.

Others taking part in the discussion were Messrs. W. R. Power, Ironton; O. H. Hutchings, Dayton, S. M. Rust, Greenville; L. C. Anderson, Franklin; J. C. Martin, F. C. Caldwell and W. S. Culver.

Central Station Management

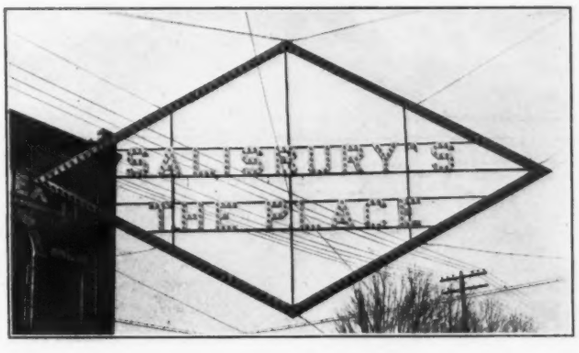
Devoted to Discussion of Administrative Policies, Commercial Methods and Current Practice Among Successful Utilities

Week-End Talks to Commercial Men

Addresses are made each Saturday afternoon by men prominent in the electrical industry to the members of the commercial department of the Louisville (Ky.) Gas & Electric Company. Mr. Joseph B. Fitzgerald, illuminating engineer of the Westinghouse Electric & Manufacturing Company, recently spoke on the nitrogen-filled lamp. A talk on the electric vehicle was also given by Mr. Henry B. Hewitt, manager of the electric-vehicle department of the Kentucky Wagon Manufacturing Company, of Louisville. It is expected that later there will be a discussion on tennis-court lighting.

A Small City's Electric Slogan Sign

Salisbury, the county seat of Rowan County, N. C., has the distinction of having erected one of the first electric "booster" signs in the Southeast. This sign, a diamond-shaped slogan structure as shown in the accompanying illustration, was placed in service through the efforts of the Salisbury Industrial Club. The slogan, "Salisbury's the Place," has become the established



ELECTRIC SLOGAN SIGN AT SALISBURY, N. C.

motto of this organization and is used, in its diamond-shaped border, on all stationery and printed matter.

The sign is 19 ft. high by 34 ft. long and contains about 345 lamps. The diamond frame is illuminated by 156 red lamps, while the slogan letters are 24 in. high and carry white lamps. Through arrangements with the North Carolina Public Service Company, both electrical energy to operate the sign and maintenance and repairs are furnished free for a period of ten years. This sign was designed by members of the local industrial club and built by the Federal Sign Company.

Free Iron Holders at Danville, Ill.

On the theory that any offer wherein the general public is given something for nothing will receive attention, the new-business department of the Danville (Ill.) Street Railway & Light Company has undertaken a reduced-price iron sale, giving with each purchase a holder by means of which an electric iron may be turned upside-down and used as a hot-plate. These holders are inexpensive, costing at wholesale about 6 cents each, so that if any are left over at the close of the iron sale they can be discreetly given away with ultimate advantage.

Reduction in Rates in Hartford, Conn.

The Hartford (Conn.) Electric Light Company announced a reduction in rates, taking effect on July 1. From that date the rate for all energy for residence and commercial light, for which the rate had been 9 cents per kw-hr. less 5 per cent for payment in ten days, was reduced to 8 cents less 5 per cent for payment in ten days throughout the entire territory served by the company, both city and suburban. In announcing the reduction the company published advertisements in the daily newspapers saying that its commodity is the only necessity of life which has been steadily reduced in price. It quoted rates and reductions from 1903, when the maximum rate was lowered from 17 cents to 16 cents per kw-hr. In making this change the company also added the 40-watt tungsten lamp to its free renewal list.

Transmission Service Supersedes Producer-Gas-Engine Plant

Discontinuing the operation of one 100-hp and one 80-hp gas engine, which had been driving 220-volt direct-current generators for seven years, the Pausian Milling Company, Brillion, Wis., will soon be receiving energy from the High Falls plant of the Wisconsin Public Service Company over a 15,000-volt transmission line through Green Bay and Wrightstown. Formerly these engines have been receiving gas from two individual gas producers. Although exhaustive tests have shown a small monetary saving in favor of the gas engines, central-station energy was chosen on account of the ease with which extensions could be made to the service and on account of the reduced personal attention and greater reliability afforded by the service.

With the installation of a 200-kw indoor type substation the system at Brillion will be changed to alternating-current operation, and it is expected that the transmission service will also be extended to Reedsville, Greenleaf, Grimms, Forest Junction, Hilbert Junction and Whitelaw. These towns and a few others, within a 30-mile radius, represent a total population of somewhat over 5000. When the lines are completed the inhabitants of these towns will receive energy from the system of the Pausian Milling Company, which in turn will purchase from the Wisconsin Public Service Company, paying $1 a kw demand plus 1 cent per kw-hr. for the energy at wholesale.

Stone quarries and small factories in this territory now operating with steam will present an excellent opportunity for the building of a motor-service load. Farmers whose land joins the transmission line have

shown exceptional interest in the project, and many of them will build their own extensions in order to secure electric service on their property. The transmission line itself, for which contracts have been let, will be erected for the most part on a wooden-pole line with the wishbone type cross-arm, steel towers being used only where a 465-ft. river span requires extra heavy construction.

Electrified Fire Engine Saves Expense

The advantage of converting horse-drawn fire apparatus to motor operation is shown by some figures compiled for a former horse-drawn fire engine which was equiped for battery drive by the New York Fire Department. The front wheels of the vehicle were replaced by couple-gear motor-driven wheels operated from a storage battery. The conversion cost $4,000, but the reduced expense at which the vehicle has since operated apparently justified the change.

Renewals and repairs for two years subsequent to the change cost $744.29. Of this amount $486.97 was spent in renewing the battery after the vehicle had been in service one year. Adding to the above maintenance expense the depreciation and battery-charging costs, the total operating expense for the two years amounted to $1,370.03, as compared with an average of $1,469.06 for horse-drawn fire engines answering about the same number of calls.

Electricity Versus Steam for Coal Hoisting

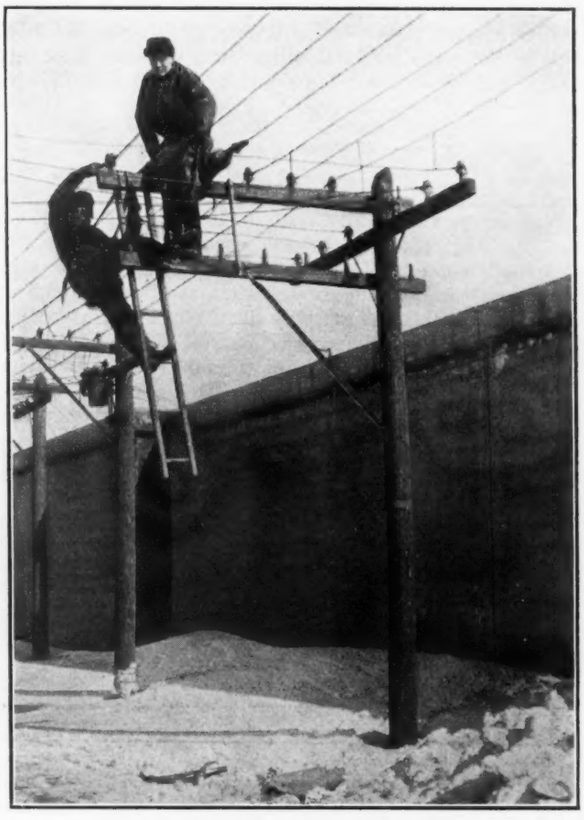
Operating data compiled by the Saw Mill Run Coal Company, Pittsburgh, Pa., on its motor-driven coal-barge unloading apparatus and on the old steam-driven equipment which has been superseded thereby show the relative power and labor costs of these two motive powers under practically identical conditions. When steam was used the items of coal and water to hoist an average of 7722 tons of coal per month cost $60 and $15 respectively. Operating the hoist with the motor now installed the cost of energy is about 1 cent per ton, which is only slightly in excess of the former power cost. But, considering labor and maintenance expenses, reliability of operation, rapidity of unloading, convenience of operation, etc., for the two systems, considerable advantage is shown to exist in favor of the electrical equipment.

When steam was used a licensed engineer had to be employed at $125 per month, but only $75 is now paid for operating the electric hoist. There are very few repairs or replacements necessary on the motor in comparison with those on the former boiler and steam engine, hence the maintenance expense is less for the present equipment. The motor does not require such frequent attention as the steam apparatus, and can always be operated without waiting for the steam pressure to rise or repairs to be made on frozen pipes. Furthermore, the steam hoist required sixty seconds to make a round trip, whereas the electric hoist can be accelerated more rapidly, making a complete trip in fifty seconds and thus allowing a 20 per cent increase in the amount of coal unloaded in a definite time. During a ten-hour day the electric hoist can transfer 5040 more bushels of coal than it had been found possible to handle with the steam hoist.

In replacing the steam equipment by the electrical outfit the only change made in the hoist was to remove the piston rods, bolt a ring gear to the crank disk and install a 75-hp Westinghouse high-torque wound-rotor induction motor with its pinion meshing in this gear. The vertical hoist from the top of the barge to the bunker is 65 ft., the radius of the swing is 110 ft., and the average length of the swing is 70 ft. Electricity for operating this apparatus is furnished by the Duquesne Light Company, Pittsburgh, Pa.

Alley-Arm Ladders for Linemen

Linemen of the Commonwealth Edison Company, Chicago, are, as a rule, instructed to work on all circuits from beneath. There are, of course, cases where this general rule is impracticable, but to make compliance more general the safety department of the company is furnishing to crews who work on alley-arm construction, ladders such as that shown in the illustration herewith. In practice the man carries the ladder up the pole, attaches it beneath the circuit upon which he wishes to work, and steps from the pole by way of



SAFETY LADDER FOR LINEMEN

the arm brace to the ladder, thus avoiding the danger otherwise involved in reaching the end of the arm by crossing over live circuits. The ladders themselves are 8 ft. long, measure from 10 in. to 12 in. wide, and are provided with heavy malleable-iron hooks shaped to fit snugly over the cross-arm.

A Dustless Housewiring Campaign at Franklin, Ky.

The Franklin (Ky.) Electric & Ice Company is conducting a spirited house-wiring campaign which is accomplishing good results in that little city of 3000 inhabitants. A special offer for July and August quotes particularly low prices, and in connection with the company's advertisement there appears its guarantee that the work will be done without noise, dirt or confusion, and without damage to walls, ceiling or plastering.

Illumination and Wiring

Lighting Display at Imperial Theater, Montreal

The electrical equipment of the Imperial Theater, the largest moving-picture house at Montreal, P. Q., includes an unusually tasteful installation of display lighting in contrast with the glaring illumination often found in such establishments. As shown in the accompanying illustration, the front of the house is provided with a harmonious combination of sign, marquise and border lighting. The dominant feature is a vertical sign containing 300 5-watt lamps, bearing the name and emblem of the house, the marquise carrying forty-six frosted lamps of the 15-watt size set 12 ft. above the street. Attractions are announced by two signs set at an angle of about 30 deg. from the wall, each containing about 200 5-watt lamps. Two hundred 10-watt lamps are used in the panels of the façade, and in the middle front of the building are mounted candelabra, each containing three 40-watt lamps mounted in a single translucent globe. Four flaming-arc lamps with a rating of 6 amp each are installed at the corners of the theater.

A MONTREAL THEATER SIGN

The equipment of the cinematograph operating room is unexcelled in Canada. The moving-picture machines are mounted in a fireproof compartment on the roof, with a 10-kw motor-generator set in a separate chamber to supply direct current at 70 volts to the cinematograph arc lamps, which are two in number and rated at 40 amp each. A spot-light and a stereopticon lamp are also installed in the operating room. The generator is driven by a 15-hp, 550-volt, three-phase induction motor built by the Canadian General Electric Company. The building is also provided with 110-volt alternating-current service and 220-volt direct-current service for emergency use, the pressure reduction being by hand-operated rheostats under such conditions. There are also four motor-driven fans in the establishment, the motors being of 7.5-hp rating each. The theater seats 2400 persons. Energy is purchased at industrial rates from the Montreal Light, Heat & Power Company, the business being of the long-hour type.

Cost of Gas and Electric Lighting Compared

In a large American city where the price of gas is 80 cents net and the price of electricity 10, 5 and 3 cents net employees of the electric-service company have made up interesting tables to show the comparative costs of gas and electric lighting on the basis of equivalent illumination. These tables, which may be of general interest, are reproduced herewith.

TABLE I—COST OF GAS LIGHTING

(Gas at 80 cents per 1000 cu. ft. Does not include mantles)

Hours' Use	1 Single Reflex	2 Four-Mantle Inverted Arc	3 Five-Mantle Inverted Arc	4 Standard Welsbach	5 Two-Mantle Upright Arc	6 Four-Mantle Upright Arc
1	$0.0059	$0.0178	$0.0280	$0.0073	$0.0146	$0.0234
2	.0089	.0298	.0358	.0117	.0234	.0410
3	.0119	.0418	.0508	.0161	.0322	.0586
4	.0149	.0538	.0658	.0205	.0410	.0762
5	.0179	.0658	.0808	.0249	.0498	.0938
6	.0209	.0778	.0958	.0293	.0586	.1114
7	.0239	.0898	.1108	.0337	.0674	.1290
8	.0269	.1018	.1258	.0381	.0762	.1466
9	.0299	.1138	.1408	.0425	.0850	.1642
10	.0329	.1258	.1558	.0469	.0938	.1818
11	.0359	.1378	.1708	.0513	.1026	.1994
12	.0389	.1498	.1858	.0557	.1114	.2170

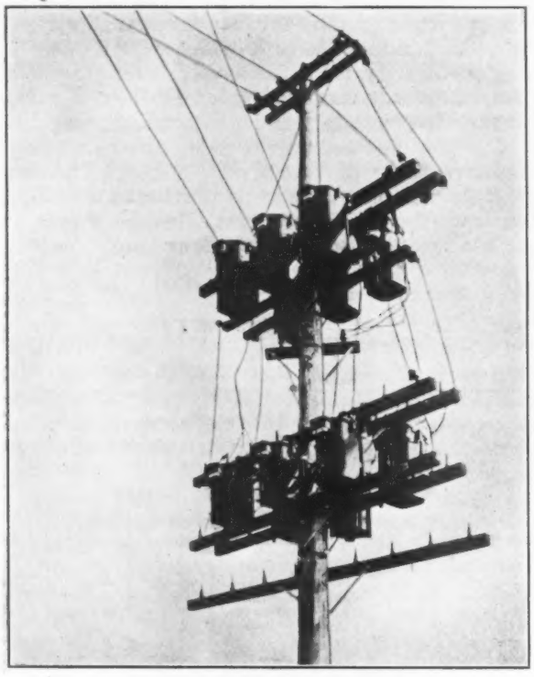
TABLE II—COST OF ELECTRIC LIGHT FOR EQUIVALENT ILLUMINATION

(At rate of 10, 5 and 3 cents per kw-hr. net, including lamp renewals)

Hours' Use	1 One 60-Watt	2 Two 100-Watt	3 One 250-Watt	4 One 40-Watt	5 One 100-Watt	6 One 150-Watt
1	$0.0060	$0.0200	$0.0250	$0.0040	$0.0100	$0.0150
2	.0090	.0300	.0375	.0060	.0150	.0225
3	.0108	.0360	.0450	.0072	.0180	.0270
4	.0126	.0420	.0525	.0084	.0210	.0315
5	.0144	.0480	.0600	.0096	.0240	.0360
6	.0162	.0540	.0675	.0108	.0270	.0405
7	.0180	.0600	.0750	.0120	.0300	.0450
8	.0198	.0660	.0825	.0132	.0330	.0495
9	.0216	.0720	.0900	.0144	.0360	.0540
10	.0234	.0780	.0975	.0156	.0390	.0585
11	.0252	.0840	.1050	.0168	.0420	.0630
12	.0270	.0900	.1125	.0180	.0450	.0675

An Interesting Temporary Transformer Installation

Lacking a three-phase, 6600/440-volt transformer with which to complete a city water-works installation, the Central Illinois Light Company, Peoria, Ill., recently devised a scheme whereby twelve smaller standard transformers temporarily supplied the customer with service. Mounting the twelve 2200/220/110-volt transformers in four banks of three each on a pole as shown in the accompanying illustration, the primaries of each group of three transformers were connected in series



TWELVE TRANSFORMERS DOING TEMPORARY DUTY FOR A SINGLE UNIT

across the 6600-volt line, forming an open delta. The secondary coils of the transformers were then grouped in pairs to deliver the desired secondary potential, 440 volts.

Guard Around Guy Wires

As an effective precaution against the danger of persons running into or stumbling over guy wires, the Wichita Falls (Tex.) Electric Company incloses the lower portion of its guy wires, to a height of 8 ft., in wooden casings painted white. The painted box warns passersby of an obstruction and in addition prevents anyone receiving an injury in case the guy is energized from an overhead conductor.

Largest Electric Roof Sign in the World

The Ontario Furniture Company, Montreal, Canada, operates what the builders contend is the largest electric roof sign in the world on top of the recently completed nine-story reinforced-concrete building of this house-furnishing establishment. The sign was erected at a cost of about $20,000, and Fig. 1 shows a daylight view of the structure, whose length is 135 ft. and whose height is 77 ft. The total weight is 32.5 tons, and the mechanical problem involved in the secure attachment of the frame to the building is indicated in Fig. 2, which shows the steelwork provided behind the sign proper and the general features of the main frame.

The sign is of the talking variety and is installed near the intersection of Bleury and St. Catherine Streets, facing the most congested traffic point in the city. It is operated with forty sentences in regular display, ten seconds being allowed for each, and is provided with forty-two letter frames and spaces wired out of doors in conduit to rotating contact-making devices housed in an 8-ft. by 16-ft. switch room shown in the central portion of Fig. 2 and illustrated by the interior view, Fig. 3. The principal decorative features of the sign are two torches at the ends, beside which are "brownies" calling attention to the trade-name of the house, which is known as the "Home of Credit," and a gold-coupon saving scheme which is popular locally. In regular operation most of these pictorial and display features are flashed on and off at intervals, accompanied by the setting up of sentences. The lower border and torches are fixed displays. The great height of the sign is apparent by a comparison of the figures of the men standing on the frame in Fig. 1 with the structure itself. About 6000 5-watt, 10-volt clear tungsten lamps are installed, each letter being fused independently at the contact maker in the operating house and provided with a sign transformer mounted on the frame. Over 25 miles of wire are installed on the sign and the wiring includes connections at 150 junction boxes, 25,000 soldered joints, 225 cutouts, 700 fuses and 1100 ft. of iron conduit. About 200 lb. of insulating tape was required, with nearly 1000 lb. of solder.

On the rear of the main frame the name of the company has recently been installed in a sign running the full length of the structure, the letters being 10 ft. high with white backgrounds and requiring about 1000 5-watt lamps. The different displays on the sign front require the use of forty-five flashers driven by three motors, the flashers being mounted at the sides of the operating room as shown in Fig. 3. The figures of the brownies at the front of the sign are 30 ft. high, the "Home of Credit" letters being 8 ft. high and the gold-coupon advertisement 12 ft. by 24 ft. The two bottom lines of lettering consist of forty-two letters in which the lamps are so arranged that any letters of the alphabet or any numeral can be displayed, the "set-up" being by templates or cams in the machinery house below. News of the hockey matches, races and elections is frequently displayed on the sign.

The frame consists of eight vertical and sixteen horizontal steel angles, the former being 3½ in. by 3 in. by 5/16 in. in size at the lower end, and the latter 3 in. by 3 in. by 5/16 in. Eight 10-in. by 12-in. diagonal braces, latticed on all four sides by 2¼-in. by 5/16-in. straps,

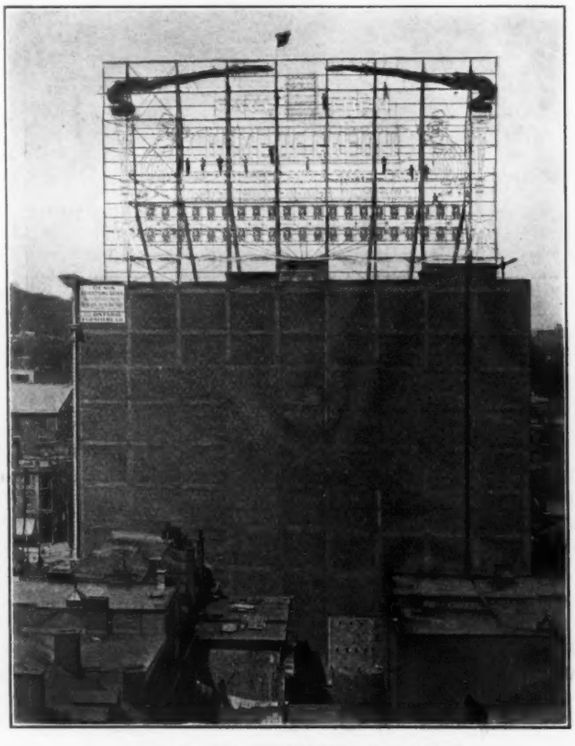


FIG. 1—DAYLIGHT VIEW OF SIGN

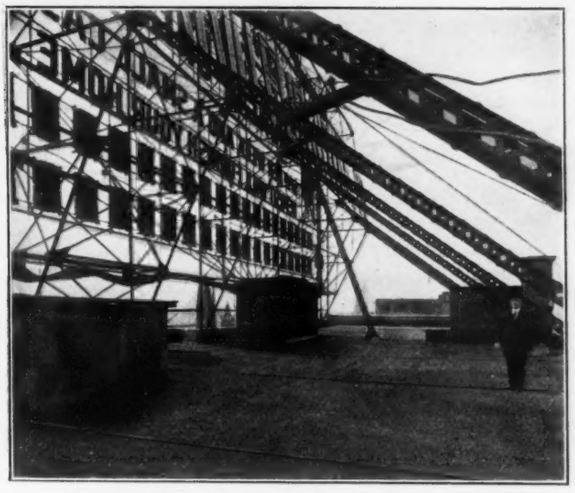


FIG. 2—REAR VIEW OF SIGN FROM ROOF

are run from the upper part of the frame to anchorages in the roof. The brace frames are composed of 2½-in. by 2½-in. by 5/16-in. angles, and each of the brace anchorages is fastened rigidly into the building frame by a pair of 1½-in. steel rods terminating at a 3-in. by 4-in. by ⅜-in. steel angle plate forced against a wooden block on the under side of the reinforced-concrete girder construction on the eighth floor. Turnbuckles in these rods provide for tightening the anchorages, and at the roof level the opposite anchorages are tied together by 1-in. steel rods, with turnbuckles in the center, as shown in Fig. 2.

The flasher equipment was provided by the National Electric Sign Company, of Jersey City, N. J., and the talking contacts are belt-and-gear-driven by a 1-hp, 110-volt Wagner motor shown in Fig. 3. The other motors required are of about ⅛-hp rating each. The sign is operated nightly from dusk until 11:30 p.m. and has never been out of commission an hour in about a year's service. Energy is supplied by the Montreal Light, Heat & Power Company, and representative consumptions are 2210 kw-hr. for April, 1914, and 3310 kw-hr. for January, 1914. One attendant is required each evening, and general oversight is exercised by Mr. F. J. Dowling, chief electrician of the Ontario company. The sign was designed and built by the Denis Advertising Signs, Ltd., Montreal, P. Q.

FIG. 3—CONTACT-MAKER ROOM

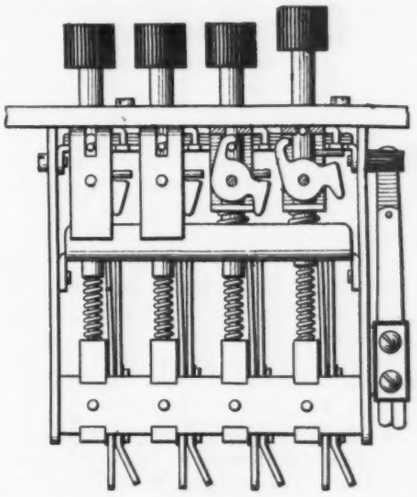
RECENT TELEPHONE PATENTS

New Apparatus

A volume-augmenting device is described in a patent granted to Mr. M. E. Pearson, of Seattle, Wash. Numerous small diaphragms are used to close apertures in one side of a fluid container, while a large diaphragm closes an aperture on the other side. The small diaphragms connect with microphone buttons, while the large diaphragm receives the vibrations to be transmitted. The deflection of the small diaphragms is augmented because of the relatively large displacement of fluid during the vibration of the large diaphragm.

A folding antiseptic device has been invented by Mr. C. Russell, of Columbus, Ohio. A liner for the mouthpiece carries at its small end an antiseptic soaked mass of fibrous material, while a folded collapsing cone of paper projects from the open end of the liner to form a trumpet to receive the lips of the user.

Many types of gang keys for ringing and other purposes to indicate the last element operated have been invented. One popular method of indication is to keep the last-operated member slightly depressed. Mr. E. B. Craft has devised a method whereby the last element used is elevated. The operation of any key push depresses all other pushes slightly and locks them. It alone, therefore, returns to the full limit when released. The cut shows a view of the key the patent for which has been assigned to the Western Electric Company.



INDICATING RINGING KEY

Mr. G. L. Hughes, of Chicago, has invented a gang switch which is operated by an electromagnet. The various switch springs are mounted in rows upon both sides of a middle spacing strip of insulating material. The pairs of springs have platinum contacts set opposite each other. An electromagnet drives a wedge between the opposing rows of springs, and this wedge carries the necessary contactors.

A patent for a protector mounting has been granted to Mr. Frank B. Cook. A cylindrical insulator carries spring clips for fuses and carbons. A metal nut embedded in the insulator affords a means of attaching the insulator to the base plate. Short nibs from the sheet-metal base piece are raised up to engage the insulator and prevent it from turning about the central mounting screw.

A patent recently issued to Mr. W. W. Dean, of Chicago, describes the structural details of a special design of a harmonic-polarized bell using a signal gong. This patent has been assigned to the Kellogg Switchboard & Supply Company.

Letters to the Editors

Sale of American Electrical Supplies in Cuba

To the Editors of the Electrical World:

SIRS:—In further discussion of the topic of "Development of Foreign Trade," touched upon editorially in the *Electrical World* of June 13, following the report of Mr. Maurice Oudin's address before the foreign trade convention as reported in your issue of June 6, I believe I can throw some light on conditions connected with the sale of American electrical devices in Cuba.

This island republic, with its 180, or more, sugar mills (all large users of electrical supplies), should be a good customer of American manufacturers. And in addition there is the very rapidly developing field of the small central stations being installed almost monthly —one might say—throughout Cuba. Of the electrical supplies consumed in Cuba, however, a great number, especially incandescent and arc lamps, lamp cord, wire, etc., are made in Germany. Oil engines are also going in, but these are usually German, Swiss or Swedish.

I do not pretend to analyze the question. But let us take an example. The German and American manufacturers were, I believe, developing the nitrogen-filled lamp about the same time. But here in Cuba German nitrogen-filled lamps with ratings all the way from 300 watts to 2000 watts in all the standard voltages were on the retail market and were being snapped up by progressive engineers as early as last December. The agents in Cuba had trouble in filling all their orders, yet at this time American manufacturers were not yet selling these lamps. Only a few sizes had been developed, and lives of 400 or 500 burning hours were all that the makers could then promise. Meanwhile the German lamps were being guaranteed for 800 hours. I used some of the German lamps more than 1000 hours with no burn-outs and no appreciable dimming. My point, therefore, is that these German nitrogen-filled lamps are now fairly well known in Cuba and it is going to be hard indeed to replace them with American lamps.

The same thing happened with the flame-arc lamps when those illuminants were first developed. Thousands of dollars' worth of German flame-arc lamps were sold and are still used.

I know that we Americans pride ourselves on being hustlers, but in some of the items that do not run into big figures in single units we overlook the large field for renewals, and as a result other countries are getting the business which should rightly go to America.

Tuinucu, Cuba. FRANK H. JONES.

A Standard Distributing Voltage for China

To the Editors of the Electrical World:

SIRS:—At a meeting of the Engineering Society of China held early in the year a committee was appointed to consider the question of standardization of a system or systems of electricity supply in China with a view to placing recommendations before the proper government authorities, officials of foreign settlements, holders (present and prospective) of concessions for the supply of electricity, and the various engineering firms concerned. In view of the multiplicity of voltages, frequencies and systems in use in other countries, it then seemed both desirable and possible to choose a single low-tension system for domestic distribution, and one, or a relatively few, standard systems for generation and transmission.

If the committee succeeds in obtaining official recognition of such a single standard system—and there is every prospect that it will—the following advantages will be secured:

(1) Buyers of electrical equipment will receive bids on a comparable basis. (2) There will be secured the possibility of interconnecting different systems and the consequent use of large generating systems, a condition quite unfeasible in many of the larger European cities. (3) The variety of electrical stock, such as lamps, meters, motors, transformers and general supplies, to be kept at the supply centers will be minimized. (4) Consumers' appliances will be rendered interchangeable.

The committee, after several meetings, arrived at the following decisions and recommendations:

(1) That generation and distribution generally shall be on a three-phase system at fifty or sixty cycles per second.

(2) That distribution shall be carried out generally on the four-wire, three-phase system with grounded neutral at a pressure of 250 volts between one-phase and neutral, that is, 440 volts (approximately) between phases.

(3) That the standard pressure for domestic lighting and similar supply shall be 250 volts.

(4) That when it is not desirable or economical to use a four-wire, three-phase supply, then a three-wire system with neutral grounded or a two-wire system with one side grounded shall be adopted, in all cases the pressure to ground being 250 volts.

(5) That the use of direct-current systems shall be discouraged and they shall not be allowed for systems involving either over 50 kw in rating or having feeders of over a half mile in length.

(6) That no fuses or switches shall be allowed in the neutral wire.

(7) That where direct-current systems are essential the generation and distribution shall be on the three-wire system at 500 volts between outers, the neutral being grounded.

In connection with the above recommendations it may be said that the committee was unanimous with regard to the method of distribution on the four-wire, three-phase system as most suited to Chinese cities.

A majority was in favor of 250 volts pressure (i.e., between one phase and neutral) on the customer's premises, those members operating systems of 200 volts and upward being of the opinion that the higher pressure of 250 volts would involve practically no additional risk, but would be distinctly advantageous as regards economy in copper, regulation, etc. The system would also allow the use of 440-volt motors on the lighting mains, and thus render unnecessary the use of different mains for lighting and for motors. This in Chinese cities would be prohibitive on account of first costs, on account of the relatively low prices that could be obtained for electric energy, and also on account of the fact that motor loads are very scattered. The American and French representatives were opposed to a maximum pressure on the secondary side higher than 250 volts, i. e., 125 volts to neutral.

Little trouble in the regulation of lighting due to interference of motor loads is anticipated, as it is found by experience that these loads generally do not coincide. The decision to allow both fifty cycles and sixty cycles as standard frequencies was arrived at in view of the fact that a single standard of fifty cycles would not receive support from American manufacturers, and the use of sixty cycles would allow of cheaper plants where first cost is of paramount importance.

R. A. WILLIAMS,

Secretary Electricity Standardization Committee of the Engineering Society of China.

Shanghai, China.

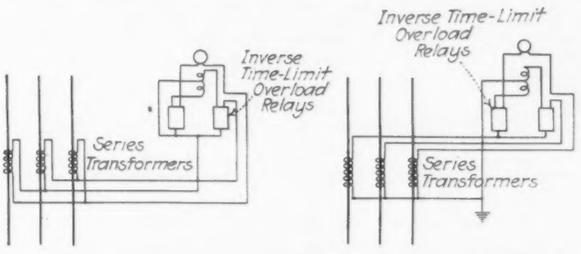
Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Star Connection of Series Transformers

BY J. G. KOPPEL

In the erection of a 25,000-volt, three-phase substation which was completed recently, series transformers connected in delta were employed to operate the inverse time-limit overload relays. Not long after the installation the insulation between the primary and



DELTA AND STAR-CONNECTED SERIES TRANSFORMERS

secondary windings of one of the current transformers broke down, allowing the high-potential energy to go to ground through the relay whose casing had been purposely grounded. The relay was destroyed by the discharge. To prevent any repetition of this trouble the transformers were reconnected in star as shown, the neutral point being grounded. As similar trouble did not again occur, the star arrangement is considered the safer method of connecting the apparatus.

Weathering of Coal and Its Effect on Heating Value

Contrary to the common belief, coal does not suffer serious losses when exposed to the elements. Exhaustive tests and researches have been made by the University of Illinois and the Bureau of Mines, and the bulletins issued indicate that the calorific loss in coal exposed to the open air for one year or more is not sufficiently great to make such open-air storage of coal prohibitive. Referring particularly to a series of tests conducted by Prof. S. W. Parr and Mr. W. F. Wheeler, of the University of Illinois, the following is taken from their conclusions:

"Coal of the type found in Illinois and neighboring states is not affected seriously during storage when only the change in weight and losses in heating power are considered. The changes in weight may be either gains or losses of probably never over 2 per cent in a period of one year. The heating value decreases most rapidly during the first week after mining and continues to decrease more and more slowly for an indefinite time. In the coals that have been tested 1 per cent is about the average loss for the first week and 3 to 3.5 per cent would cover the losses for a year."

For reference a table of values showing the results of six weathering tests of Vermilion, Williamson and Sangamon (Ill.) nut and screenings is shown.

WEATHERING TESTS OF COAL

	Ash	Sulphur	Lb.-Fahr. Heat Units	Heat Units Referred to Actual or Unit Coal	Lb.-Fahr. Heat Units	Decrease, per Cent.
Stored in exposed bins:						
Same day as mined	15.26	4.03	12,224	14,787	....	....
Seven days after mining	15.13	3.53	12,164	14,666	121	.82
Two months after mining	15.68	3.61	12,024	14,606	181	1.22
Six months after mining	14.96	3.36	12,081	14,525	262	1.77
One year after mining	14.33	3.29	12,065	14,379	408	2.76
Stored in covered bins:						
Same day as mined	15.26	4.03	12,224	14,787	....	....
Seven days after mining	15.13	3.53	12,164	14,666	121	.82
Two months after mining	15.07	3.53	12,128	14,605	182	1.22
Six months after mining	14.42	3.37	12,105	14,453	334	2.26
One year after mining	14.77	3.57	11,945	14,323	464	3.14
Stored under water:						
Same day as mined	15.26	4.03	12,224	14,787	....	....
Same day as submerged	15.13	3.53	12,164	14,666	121	.82
Six months after mining	15.84	3.69	11,937	14,532	225	1.73
One year after mining	15.02	3.81	12,090	14,567	220	1.49

A New Thermoscope

BY F. A. J. FITZGERALD

In a paper on "A New Automatic Fire Alarm" published in the *Journal of Franklin Institute*, November, 1913, the writer described an invention of Mr. Garretson, which consists in the use of a substance having a negative temperature coefficient as a thermoscope. This apparatus has been the subject of a large amount of research work in the laboratories with which the writer is connected, with the object of producing a commercial thermoscope for various purposes, and since the paper mentioned above was published further developments of some interest have been made.

The so-called thermitite, which is used in making the thermoscopes, is a preparation of silver sulphide which has a very large negative temperature coefficient of electrical resistivity. To give some notion of its behavior as a resistor the curves in Fig. 1 may be referred to. These were obtained by the measurement of a rod of thermitite with threaded ends to which silver terminals were screwed. The electric current was supplied from a small induction coil, and the thermitite formed one arm of a Wheatstone bridge, a telephone receiver being used to find when a balance was obtained. The rod was immersed in an oil bath which was heated by means of a current passed through a nichrome resistor.

The temperature-resistance curve is drawn in two scales, the first showing the change in resistance between 19 deg. and 150 deg., and the second, a large-scale curve, showing the change in resistance between 140 deg. and 166 deg. This is done in order to show the curious change in the curve which occurs somewhere between 157 deg. and 162 deg. This sudden change of resistance in the thermitite is very characteristic and is of considerable practical importance, as will appear later.

In this determination of the resistance of thermitite we may safely assume that the resistances correspond-

ing to the various temperatures are approximately correct, for the temperatures of the oil bath probably represent fairly accurately the temperature of the thermitite rod. When, however, the thermoscopes themselves are used for resistance tests, it is no longer safe to assume that the temperature as indicated by a thermometer in the oil bath or oven in which the thermoscope is placed gives the true temperature of the thermitite. The reason for this is that while the testing current is too small to have any appreciable heating effect on a relatively massive rod of thermitite, it has a distinct effect in the case of the thin strips of thermitite used in the thermoscopes.

The thermoscopes are made by mounting a strip of thermitite about 0.5 mm thick, 5 mm wide and 5 mm to 10 mm long in a suitable holder. For use in places where it is desired to indicate the existence of a high temperature the thermoscope is placed in a circuit provided with an alternating current, and in the same circuit an 80-ohm drop is placed where the indication of an excessive temperature is to be given. The 80-ohm drop works with a current of about 30 milliamp, but the resistance of the thermoscope is so enormously high at ordinary temperatures that no appreciable current passes. If, however, the temperature of the thermoscope is raised, its resistance decreases and the resulting increase in current tends to raise its temperature still more, till finally the point is reached where sufficient current passes to work the drop.

The first use to which the thermoscopes were put was in fire-alarm circuits, but recently thermoscopes have been constructed for use as hot-bearing alarms and for indicating excessive temperatures in cable conduits and transformers.

The diagram of Fig. 2 illustrates the use of the thermoscope as a hot-bearing alarm. In the diagram, *B* represents the bearing fitted with the thermoscope *T*, connected in the circuit from the transformer *G*, which also includes the drop *R* and the alarm gong *A*. The

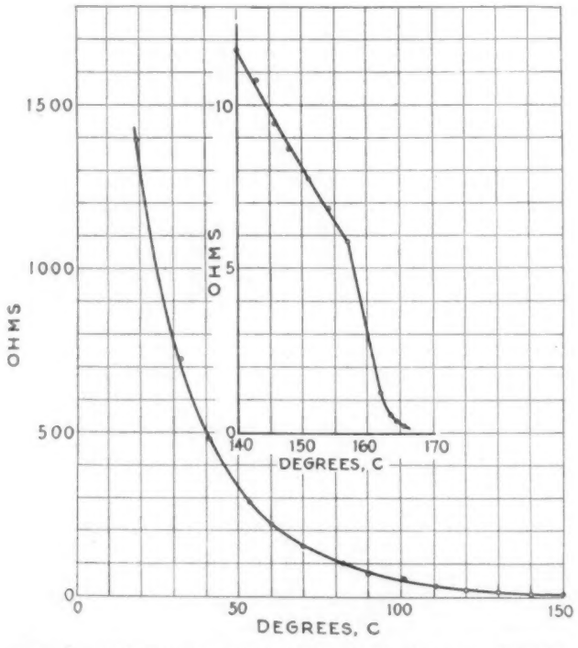


FIG. 1—RESISTANCE CHARACTERISTICS OF THERMITITE

thermoscope is made of brass and threaded so that it may be screwed into the bearing. Where several bearings have to be watched a separate circuit is used for each thermoscope and its corresponding drop, the several drops being mounted as on a telephone switchboard, but the same bell and transformer are used for the whole installation.

For use as an alarm in cable conduits the thermoscope is in the form of a brass cylinder which can be drawn into the conduit where desired, with, of course, the

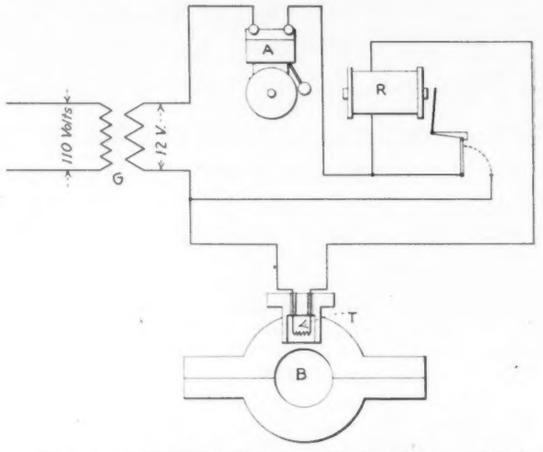


FIG. 2—THERMOSCOPE AS HOT-BEARING ALARM

wires attached for connecting the thermoscope in its circuit.

In the case of oil-cooled or water-cooled transformers the thermoscope is in the form of a small cylindrical brass box which can be placed in the oil at whatever point it is desirable to keep under observation.

As regards the temperature at which the thermoscopes work, this can be made anything desired. In a recently constructed thermoscope for transformers the alarm circuit was provided with a bell-ringing transformer having a 110-volt primary circuit and secondary circuits of various voltages. The temperatures at which the alarm was given were then obtained at various voltages by immersing the thermoscope in an oil bath similar to that used in the resistance tests and noting the temperature at which the alarm was given. The results obtained are given in the accompanying table.

FIRE-ALARM-TEST RESULTS WITH NEW THERMOSCOPE

Volts	Temperature, C.	Temperature, Fahr.
15	70 deg.	158 deg.
20	58 deg.	136 deg.
25	46 deg.	115 deg.
30	39 deg.	102 deg.

Transformer Coils in Parallel

A transformer core is wound with two separate coils of the same size and kind of wire, but one has 300 turns and the other has 400 turns. When they are connected in parallel and subjected to a certain alternating emf, what is the resultant value of the core flux? H. M.

When the coils are operated separately the currents in the two coils tend to produce different values of flux, the larger flux being produced in the coil with the smaller number of turns. When the coils are connected in parallel there is produced a local circulating current which so varies the excitation that the resultant magnetomotive force assumes such a value that the core flux is equivalent to that due to a coil of about 350 turns—the average of the two coils. The value of the resultant core flux is much too large for one coil and too small for the other, and the local circulating current is usually heavy enough to destroy one or both coils.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Differential Method of Testing Transformers.—A. E. CLAYTON.—One great drawback to the ordinary Sumptner test and its modifications is due to the fact that in addition to the main supply an auxiliary transformer is required, which must be of the correct capacity as regards both current and pressure. The method developed by the author requires but one source of supply and is exceedingly easy to carry out. With small ratios of transformation the method can be employed to test a number of transformers at the same time, thus affording a considerable economy in works testing. The diagram of connections for the author's test on two similar transformers is shown in Fig. 1. The two secondary windings are connected in parallel and energized at the correct pressure and frequency. The primary windings (high-tension) are connected in opposition and in series with an adjustable resistance across the secondary terminals of the transformers as shown. The current which flows in the high-tension windings is, therefore, due to the pressure supplied to the low-tension coils. Its value depends upon the leakage impedance of the two transformers in series, together with the impedance of the connections from *a* to *b*. The maximum possible current is obtained when *a* and *b* are short-circuited. Under this condition the current in the high-tension windings is given by dividing the applied secondary pressure by the series leakage impedance of the two transformers. For example, with two transformers each having a leakage impedance of 3 per cent for a transformation ratio of 100/6, normal full-load current would circulate in the high-tension windings when *a* and *b* are short-circuited. For a greater transformation ratio it would be impossible to obtain full-load current with a leakage impedance of 3 per cent or more. To apply the test in such a case it is only necessary to alter the transformation ratio to one-half its normal value, by splitting up the primary into two groups and connecting them in parallel; the current per circuit must, of course, be kept at its normal value and the total current doubled. Neglecting the magnetizing current the total volt-amperage required for the test is given by the product of the primary high-tension current in amperes and the secondary volts. Hence for a transformation ratio of ten to one, two transformers can be tested under full-load conditions with one-tenth of the full-load volt-ampere rating of one of the transformers. For a transformation ratio of five to one the consumption is one-fifth and so on. The connections shown in Fig. 1 are those for a temperature test, which is exceedingly simple to carry out by this method. If

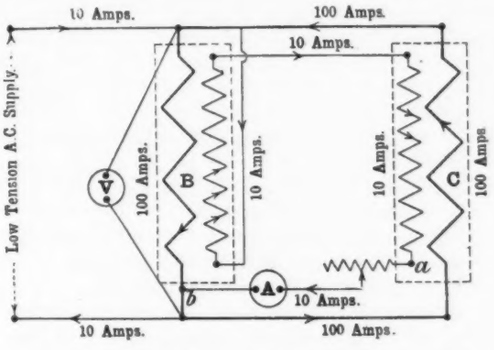


FIG. 1—CONNECTIONS FOR HEATING TEST

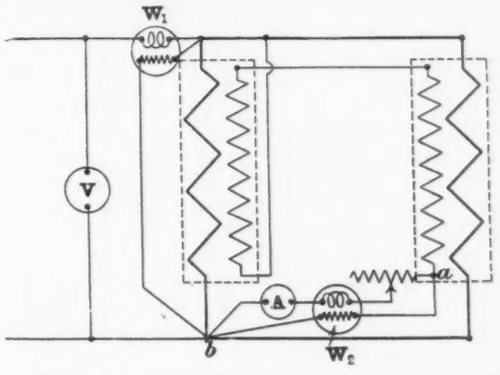


FIG. 2—EFFICIENCY TEST ON TWO TRANSFORMERS

necessary the efficiency can be determined at the same time by introducing wattmeters to measure the losses in the transformers. To do this two wattmeters W_1 and W_2 (Fig. 2) are necessary. The first (W_1) gives the total power supplied to the system, the second (W_2) gives the power wasted in the path from *a* to *b*, including the loss in the ammeter and series coils of the wattmeter. The difference $W_1 - W_2$ gives the actual transformer losses obtained. Details are given of the experimental results obtained with this method in several specific cases where it was tried.—London *Electrician*, July 10, 1914.

General Transformer.—H. KAFKA.—The first part of a mathematical paper on the construction of the exact circular diagrams for the polyphase induction motor (the "general transformer") from the ordinary Heyland diagram.—*Elek. u. Masch.* (Vienna), July 12, 1914.

Lamps and Lighting

Electric Lighting for Workmen's Houses.—LAMPL.—The author emphasizes that it is important for central stations to try to introduce on a large scale electric lamps into workmen's houses. Even if gas for cooking is considered a luxury in such houses, electric lighting will be able to compete with the kerosene lamp, but to encourage this development it is necessary to make the wiring installation as inexpensive as possible, to exchange lamps free, and to employ a flat rate with weekly payments. The experience obtained in the English city of Wednesbury is discussed.—*Elek. Zeit.*, June 18, 1914.

Electricity and Gas.—E. WIKANDER.—The author discusses how the present competition between electricity and gas may be rendered less sharp. He urges that electricity be pushed for lighting and gas for heating and cooking. Electric lighting should compete with the kerosene lamp and should displace it completely in cities.—*Elek. Zeit.*, June 25, 1914.

Traction

Traction Efficiency of Direct-Current Systems.—J. LISKA.—The conclusion of his illustrated article on the effect of the motor characteristics on the traction efficiency of direct-current traction systems. In the present instalment the author discusses the motor with saturated iron, the motor with weakening of the field, and the shunt motor, and sums up the results for the different types of motors in a series of curves.—*Elek. u. Masch.* (Vienna), July 12, 1914.

Installations, Systems and Appliances

Direct-Current Motor Starters.—An illustrated description of a new compression-type direct-current motor starter of Ferranti. The whole of the resistance material remains in circuit throughout the process of starting up. A perfectly even reduction of resistance is obtained, and hence there is no sparking except when the circuit is finally broken on the first contact when stopping the motor. The resistance will stand a temperature up to 1200 deg. Fahr. without the slightest injury. All connections are accessible from the front. Replacement of the unit can be carried out on the site at a low cost and is the work of a few minutes only. The resistance element of the starter consists of a column of graphite and nickel disks interspersed, contained in a tube of special heat-resisting insulating material which is inclosed in a steel case. The complete resistance is mounted on the back of an iron face-plate, and compression of the column of disks is effected by a powerful system of toggle-levers connected to the operating lever.—London *Electrician*, July 3, 1914.

Switching Phenomena.—W. LINKE.—The first part of a paper in which the author gives a review of the switching phenomena occurring with electric machines and transformers. Avoiding a mathematical treatment, the author emphasizes the physical explanation of switching phenomena with the aid of oscillograms. The disadvantages and dangers of switching processes and the means of making them harmless are discussed. Two types of switching phenomena are distinguished. The first, comprising essentially rises of currents, occurs at approximately normal frequency. The second type, comprising essentially dangerous rises of voltage, occurs at a much higher frequency. In the present instalment the author discusses the phenomena in switching in an inductance without or with iron, switching in a transformer, switching off inductances or transformers, and switching in three-phase windings like the stators of three-phase motors while the rotor is open. The article is to be continued.—*Elek. Zeit.*, July 2, 1914.

Electric Equipment of Dock.—An illustrated article on the electric equipment of the new joint dock at Hull, which is the first in Great Britain to be operated entirely by electricity. The whole of the energy required is obtained from the lines of the Hull municipal station. The dock was erected jointly by the North Eastern Railway Company and the Hull & Barnsley Railway Company.—London *Electrician*, June 26, 1914.

Wires, Wiring and Conduits

Electric Mains Explosions.—The report of a committee, consisting of Messrs. T. E. Thorpe, R. Nelson, W. Slingo, J. Swinburn and A. P. Trotter, appointed to consider the cause of the explosions which had occurred in connection with the use of bitumen in laying mains at Nottingham, Hebburn and elsewhere, and to suggest any steps which should be taken to prevent explosions in future from the use of this or similar substances. The conclusions of the committee are as follows: The committee finds that the explosions to which its attention has been directed have occurred in connection with electric supply by continuous current through separate cables, for the most part insulated with vulcanized bitumen and either drawn into bitumen casing or laid solid in troughs filled with bitumen. The committee finds that no serious explosions have occurred where the supply has been by alternating current, or where concentric or three-core or lead-covered paper-insulated cables have been used, or where cables have been laid solid in pitch compound; but a direct comparison between bitumen and pitch compound cannot be made as the former material has been more extensively used than the latter. In view of the small number of serious accidents which have occurred, compared with the large extent to which vulcanized bitumen cables laid solid in bitumen have been used, the committee is unable to recommend the board of trade to discontinue to approve of this system. In view of conflicting opinions of witnesses the committee cannot recommend that iron or stoneware troughing should be used to the exclusion of wood, but it recommends that wood troughing should be used only where it can be ascertained that the soil is suitable; that where separate mains are laid in troughing each cable should be laid in a separate trough, and that between the troughs there should be a space not less than 2 in. tightly packed with earth or sand. The committee recommends: (1) that separate mains for continuous-current supply should not be laid on the solid system below impervious pavements or close to the walls of houses; (2) that easy bends should be laid at corners and the bitumen or pitch compound should be poured after the straight lengths have cooled; (3) that where sharp corners of troughing are suspected to exist the mains should be opened up and the corners eased; (4) services should be taken into houses (preferably by the use of armored cables) in such a manner that gas cannot enter.—London *Electrician*, July 10, 1914.

Electrophysics and Magnetism

Disintegration of Ion Cluster in a Gas Under Influence of Electric Field.—R. D. KLEEMAN.—An account of an experimental investigation the chief results of which are as follows: Experimental evidence was obtained that the negative-ion clusters in a gas are gradually disintegrated through bombardment by neutral molecules, and consequently a condition of equilibrium is that the free negative ions shall gradually form clusters. The average period of life of a negative-ion cluster in air at atmospheric pressure, not specially dried, was calculated to be 4.2×10^{-7} sec. and that of an elementary negative ion 1.1×10^{-8} sec. The corresponding periods of life in CO_2 were shown to be of the same order of magnitude. Evidence was also obtained that the velocity of a negative-ion cluster is greater than proportional to the electric field whose order of magnitude is the same as that readily producing ionization by collision. This is the case in air not specially dried, for values of X/p equal to 173 and higher, where X denotes the electric field per centimeter and p the pressure of the gas in millimeters of mercury. The negative-ion clusters in a gas are disintegrated by an electric field if of sufficient strength through the velocity given to the clusters, the field being of the same order of magnitude as that producing ionization by collision. The magnitude of the effect, like ionization by collision, gradually increases with increase of electric field, which is best shown by curves. It may be stated, however, that the clusters are disintegrated in the case of air, CO_2 and H_2, when X/p has respectively the values of approximately 320, 640, 53 and higher. It may happen that for a certain pressure of the gas and intensity of electric field the chance of a negative cluster's getting broken up in passing over a given dis-

tance is less than the chance of a positive ion's producing a new ion by collision. The number of different clusters in a gas is to a certain extent indicated by the kinks on a curve. It appears that the majority of negative clusters consist of one kind only. The kinks in the curve enable us to obtain the mean free path of disintegration of a cluster under the conditions of the experiment, that is, the distance a cluster has to run under the electric field before getting disintegrated. Thus, when the disintegration was due to the effect of the electric field, the mean free path was 0.5 cm in the gases CO_2 and H_2, corresponding to pressures of 4 mm and 15 mm of mercury, and the fields 3720 volts and 960 volts per cm. A theoretical formula for the mean free path of disintegration was deduced.—*Philos. Mag.*, June 19, 1914.

Units, Measurements and Instruments

Electro-Cardiography.—An illustrated account of recent progress in the study of heart diseases by electrical means as developed especially by Einthoven. The chief part of the apparatus is a special form of Einthoven galvanometer. Its essential feature is a fine silvered glass fiber or "string" about 0.002 mm in diameter contained in a dust-tight metal case *E* and placed between the poles *AA* of a powerful electromagnet (Fig. 3). The field coils *BB* of the galvanometer are wound in two sections and brought up to two sets of terminals, *MN*, on the top of the galvanometer. In this way series or parallel connections may be used, and one galvanometer is available for operations on two pressures, say 110 volts and 220 volts. Field coils for 10 and 20 volts, direct current, for operation from accumulators are also made, the consumption on normal voltage being approximately 60 watts. The sensitivity of the galvanometer may be varied within wide limits by increasing or decreasing the tension on the gal-

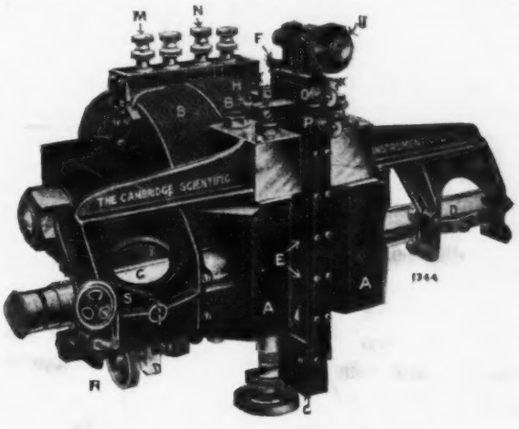


FIG. 3—STRING GALVANOMETER

vanometer string by means of the screw *J*; increase of tension causes decrease in sensitivity and vice versa. An important feature of the Einthoven galvanometer is that varying the sensitivity does not affect the damping, the movements of the string being dead-beat under all working conditions. The currents due to the activity of the heart are made to pass through the conducting string of the galvanometer and the resulting deflections are magnified about 600 times by means of a microscope *GD*. These deflections are photographically recorded on a moving sensitized plate or bromide paper. Owing to its extremely small weight and short period, the string, when properly adjusted, responds accurately to very rapid variations of current without either "overshooting" on the one hand or "lag" on the other, so that each deflection gives a true indication of the instantaneous emf values. The record of the movements of the string is known as an electrocardiogram. The arrangement of the auxiliary apparatus is also described and some typical electrocardiograms are shown. One of the advantages of the electrocardiographic method of studying the heart is that the patient may be at a considerable distance from the instrument, all that is required being a length of cable to connect the patient to the galvanometer. In hospitals it is often the practice to run small three-wire cables permanently between each ward and the electrocardiograph room; this obviates the necessity of moving the patient (which is frequently inadmissible) and makes it easily possible to obtain records from patients in any part of the hospital.—London *Electrician*, June 26, 1914.

Thermo-Element.—An illustrated description of a quick-acting thermo-element of J. H. Mott, based on the principle that the radiation should fall upon as broad a surface as possible. The thermo-element is composed of a large number of metal strips constructed as shown in Fig. 4. There *ab* is a strip of constantan,

FIG. 4—THERMO-ELEMENT

bc is a strip of copper and the ends *a* and *c* are soldered to copper bars *e* and *f*. The whole surface of the constantan-copper strips is exposed to the radiation, whereby, as a result of the greatly different heat capacities of the two soldering points, *b* is heated to a higher temperature than *a*. On account of the good heat conductivity between the soldering points temperature equilibrium is obtained after a very short time. Since constantan and copper have different heat conductivities the thickness and length of the two metallic strips are chosen so as to be different and in such ratio that during the radiation the temperature of the metallic strip is a maximum in *b*. This thermo-element is five times faster in action than that of Rubens.—*Elek. Anz.*, June 11, 1914.

Measuring Small Losses in High-Frequency Systems.—A. HUND.—An abstract of a thesis presented to the Institution of Technology of Karlsruhe. The method of the differential transformer developed by Hausrath for measuring audible frequencies is applied by the author to investigating high-frequency currents. The principle of the differential transformer is that it is arranged with one secondary coil around which are wound two identical primary coils, the current passing through them in opposite direction. These primary coils always have the same effective resistance, the same effective self-inductance, and the same mutual inductance. If an alternating current is impressed on two circuits in parallel each containing one of the primary windings, there will be no current in the secondary coil if the currents in the two branch circuits of the primary have the same intensity and phase. The author describes the difficulties which had to be overcome in the application of this method to high-frequency currents. The arrangement of his method is described and illustrated and it is stated that it is very suitable for determining the losses in condensers, the high-frequency resistance of coils, etc.—*Elek. Zeit.*, June 18, 1914.

Magnetograph.—F. E. SMITH.—A brief note on a (British) Physical Society paper on a magnetograph for measuring variations in the horizontal intensity of the earth's magnetic field. In the case of unifilar instruments for recording variations in *H*, if θ is the

angle which the magnetic system makes with the magnetic meridian, M the moment of the magnet, and H the horizontal intensity of the earth's field, equilibrium results when $MH \sin \theta = T \Phi$, where Φ is the torsion on the fiber and T is a constant. In the instrument described Φ may be made great or small, but high sensitiveness is secured by making Φ great. The magnet system is supported by a quartz fiber, and a periodic damping is obtained by means of an aluminum vane and two parallel damping plates. To diminish the sensitiveness the effective length of the fiber may be reduced. The general usefulness of the instrument is illustrated by photographic records, which show the instrumental peculiarities to be very small, and indicate that unless the system is aperiodic increased difficulty must result in the interpretation of the records. An over-damped system responds but slightly to rapid pulsations in H, but follows the slow changes which are common all over the world. The general sensitiveness of the records is about 3 mm for a change in H of 0.00001 c.g.s. unit, but one record shows a displacement of 8 mm for such a change.—London *Electrician*, July 3, 1914.

Telegraphy, Telephony and Signals

Telephone Transmission Lines.—A note on a recent British patent (No. 18,018, 1913) of the Western Electric Company and F. T. Woodward for a method of constructing an artificial line to correspond with, or balance, a loaded transmission line. The principle upon which the method depends may be stated thus: the impedance of a long, periodically loaded transmission line, beginning at the fractional part 0.17 to 0.20 section, may be approximated to, at frequencies below the critical frequency, by a three-branch network consisting of a constant resistance in series with a combination consisting of a capacity in parallel with a high time-constant inductance. If L and C are the inductance and capacity, respectively, of the transmission line, the values of the resistance, inductance and the capacity of the artificial line should be $\sqrt{L/C}$, $0.3\,L$, and $0.53\,C$ respectively. Further particulars are given to suit cases where the loaded line does not begin at about 0.2 section.—London *Elec. Eng'ing*, June 25, 1914.

Telephone Transformer.—EUGENE C. HELWIG.—An account of an experimental investigation the object of which was to show the effects of the iron core on the secondary current of a telephone transformer. A new method of investigation was developed and the following conclusions were reached by the author: The value and effect of the eddy currents produced in the iron-wire core are very much greater than is generally supposed, and their effect upon the secondary current wave-form in the telephone transformer should not be neglected. In order to eliminate the effect these eddy currents produce upon the secondary wave-form, it is necessary only to design the core in such a manner that the eddy currents produced in it will have the same wave-form as the current produced in the secondary winding. In order to accomplish this, the equivalent resistance, self-inductance and mutual inductance between the eddy-current circuit and the primary circuit should be equal to the corresponding constants of the secondary circuit. In a transformer thus designed the value of the secondary current at any time would be less than the value of the current in the secondary of a transformer having the same circuit constants and no iron core, but the wave-forms would be identical. The reduction in the amount of energy transformed from the primary circuit into the secondary circuit in a transformer with an iron core, as compared with the amount of energy transformed in a transformer having the same circuit constants but no iron core, is a matter of small importance compared with the necessity of reproducing the primary wave-form in the secondary. From his results the author concludes that his method of improving telephone transformers is the only practical one.—*Rensselaer Polytechnic Institute, Engineering and Science Series*, No. 6, 1914.

Cable Steamer.—An illustrated description of the new cable steamer *Edouard Jeramec* built for the Compagnie Française des Cables Télégraphiques is given, including a detailed account of the cable machinery and gear.—London *Electrician*, July 3, 1914.

Book Reviews

THE PRINCIPLES OF AUTOMATIC TELEPHONY. By Walter Atkins. London, England: The *Electrician* Printing & Publishing Company, Ltd. 48 pages, 32 illus. Price, 2 shillings.

A little book treating in some detail the principles underlying automatically operated telephony as practised in Great Britain according to the Strowger and Lorimer systems. By use of a number of clear diagrams and photographs the author presents enough of the fundamentals to give the reader a fair idea of the several common types of selecting, calling and talking apparatus, together with their circuits. The book should prove interesting and valuable to anyone who desires a simple presentation of the basis upon which this branch of wire telephony is being extended.

ELEMENTARY STATICS. A Supplement to Franklin and MacNutt's "Mechanics and Heat." South Bethlehem, Pa.: Franklin, MacNutt & Charles. 48 pages, 65 illus. Price, 50 cents.

A supplementary annex to a textbook on mechanics and heat. The treatment is essentially physical and intended to develop physical conceptions in the mind of the student concerning the statical phenomena analyzed. That is to say, the method of teaching is based on the development of physical concepts rather than on mathematical concepts. Incidentally, some very practical cases of statics in every-day student life are analyzed. To those who believe in this method of presentation the pamphlet will be welcome. The number of problems presented and discussed makes the pamphlet thoroughly practical for classroom use in the teaching of elementary statics.

HOW TO BUILD UP FURNACE EFFICIENCY. By Jos. W. Hays. Published by the author at Rogers Park, Chicago, Ill. 126 pages, illus. Price, $1.

This is the seventh edition of a work that represents an attempt to omit technical language and to write something about furnace losses and efficiency that any reader may understand. The author succeeds admirably. To accomplish this he has adopted a colloquial style that serves to drive home the fundamental truths relating to the efficiency of combustion in boiler furnaces. His wide experience in ferreting out the causes of low efficiency and devising methods of correcting such faults have given him familiarity with his subject, and this is evidenced by the directness, clearness and certainty with which he writes. The book first takes up the various causes of reduced furnace efficiency and then proceeds to show how that efficiency may be raised again to normal. Much of the information contained in the book has been presented before, but it is safe to say that even the most familiar facts will carry a new significance to the reader because of the forceful style of the author. Every fireman should have a copy—and read it.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Electric-Horn Push-Button

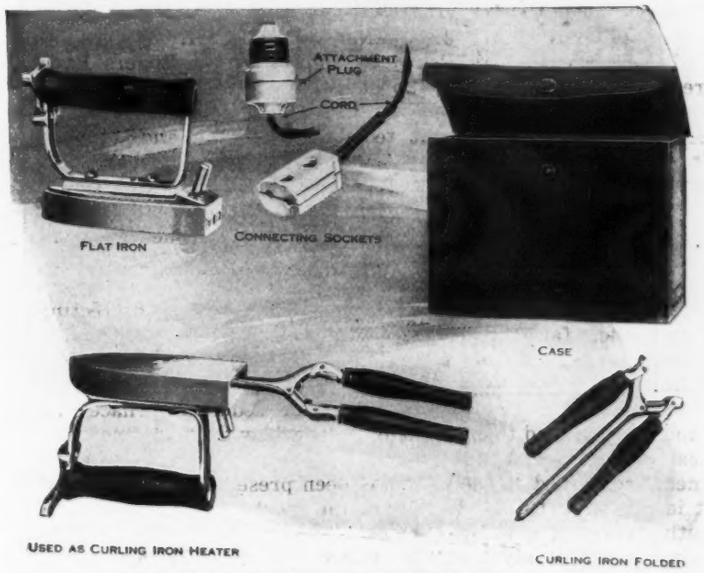
A small push-button for use on automobiles, and which can be placed close to the driver's right hand, is being made by the Typhoon Signal Company, Lincoln, Ill. The wiring to the button is concealed in a tube with a

PUSH-BUTTON WIRING FIXTURE

bend near the upper end running alongside the steering column. The tube is fastened to the column by two brackets. At the lower end of the fixture a flexible tube 6 in. long is attached, allowing for offset on the steering post.

Combination Electric-Heating Set

A combination set consisting of a 2-lb. electric flat-iron (which can also be used to heat water or a curling iron), a cord and plug, a folding curling iron, and a hand-sewed leather case in which the set can be placed when not in use, is being introduced by the Menominee Electric Manufacturing Company, Menominee, Mich. The total weight of the set is only 2.75 lb., and the outfit is therefore convenient for traveling. All metal parts are nickel-plated and polished.



COMBINATION ELECTRIC-HEATING SET

Direct-Current Portable Meters

Direct-current portable ammeters, voltmeters and millivoltmeters of the D'Arsonval type are being made by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa. These instruments are 5 in. in diameter and are direct-reading. The complete moving

FIG. 1—PORTABLE VOLTMETER

element is mounted as a unit. An aluminum pointer is used, making it possible to have a light counterweight and therefore a light-weight movement. The scale is made of metal and subtends an arc of 90 deg., giving large open divisions which are uniform throughout. Each meter is mounted in a morocco-covered wood case with heavy beveled glass over the dials. The terminal stud has a V-shaped groove into which the wire lead is inserted; this grooved stud is shown in Fig. 2.

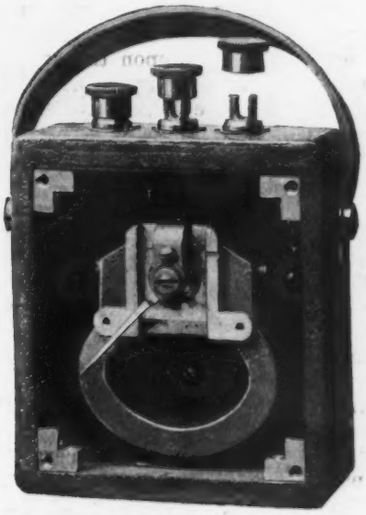


FIG. 2 — PORTABLE VOLTMETER WITH COVER REMOVED

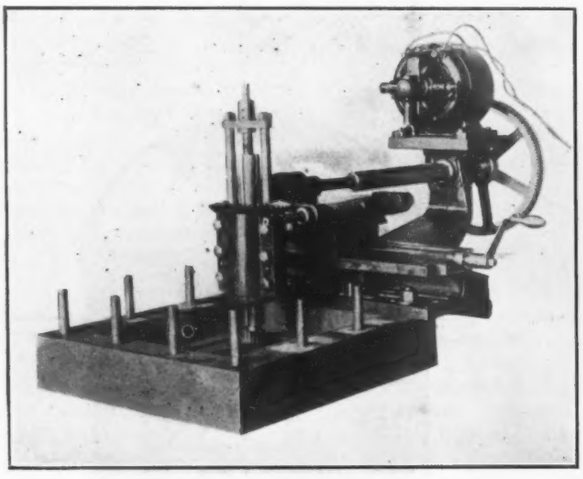
Ceiling Fan

A 55-watt ceiling fan with motor which can be detached without removing the fan and its support is being placed on the market by the National Motor & Manufacturing Company, Baltimore, Md. In the accompanying illustration is shown the method of removing the motor through the doors, which are open. The fan may be operated on either alternating current or direct current. For shipping purposes the fan can be easily disassembled.

CEILING FAN, SHOWING METHOD OF REMOVING MOTOR

Portable Milling Machine

A portable milling machine for milling engine and pump valve-seats and port edge, key-seating shafts, facing pads on large frames, etc., is shown herewith. The machine can also be used as a drill, although not designed for that particular purpose. In the illustration the machine is shown milling the seat and port edges of an engine valve, the method of mounting, by means of bolts through longitudinal slots in the base being clearly shown. The spindle stands clear of the base so that the work is not smothered. The longitudinal travel is 12 in., cross travel 6 in., and vertical adjustment 6 in. Hand adjustment is provided for the longitudinal and cross travels in order to avoid the weight and complication necessary with automatic adjustment. This machine is being made by the Pedrick Tool & Machine Company, Philadelphia, Pa., and is operated by a Westinghouse 0.25-hp motor.



PORTABLE MILLING MACHINE

Swivel Attachment Plug

An exploded view of a swivel attachment plug made by the Trumbull Electric Manufacturing Company, Plainville, Conn., is shown herewith. By pressing down on the catch marked in the illustration, the bottom of the plug drops out and the device is then open. This catch also acts as a lock.

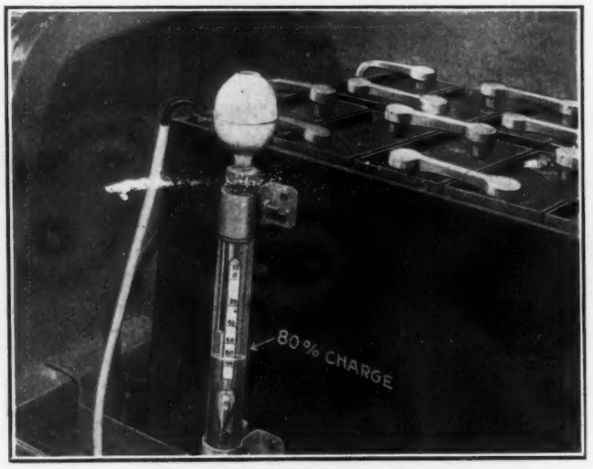
The plug is made of fireproof material, and, according to the claims of the manufacturer, the operation of wiring it is an easy one.

ATTACHMENT PLUG

Instrument for Indicating Condition of Battery Charge

A so-called "milostat" for indicating the condition of charge of an electric battery at all times is shown in the accompanying illustration. This instrument is in principle a hydrometer, but instead of being graduated for specific-gravity readings, the divisions are made to represent percentages of the acid-density range from full charge to full discharge. If, for instance, the battery is designed to operate the car for 100 miles on one charge, 100 per cent represents a total distance of 100 miles.

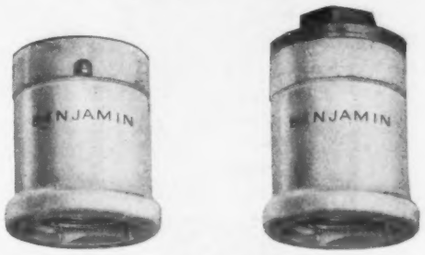
This instrument is being placed on the market by the Fritchle Automobile & Battery Company, Denver, Col.



HYDROMETER FOR SHOWING CHARGE OF BATTERY

Large-Base Sockets for Nitrogen-Filled Tungsten Lamps

As part of an assortment of fixtures for gas-filled tungsten lamps the Benjamin Electric Company, Chicago, Ill., is placing on the market two so-called "mogul" base sockets. These sockets are two-piece porcelain devices and are provided with means for attaching to

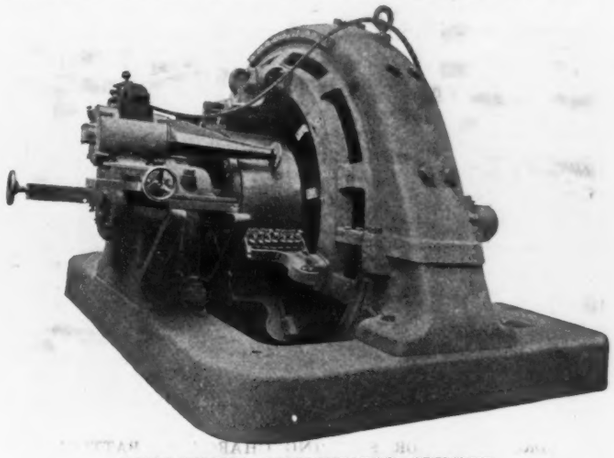


FIGS. 1 AND 2—LARGE-BASE SOCKETS FOR HIGH-CANDLE-POWER TUNGSTEN LAMPS

a flange or surface. The base portion carries the binding terminals, which are easily accessible for wiring. With the socket shown in Fig. 1 wires are brought in through side outlets in the upper part, and with that shown in Fig. 2 through the central opening. The lower portion of these sockets is provided with a shell and bronze-spring center contact, and can be used interchangeably with either socket.

Commutator-Grinding Machine

A long-snout grinder for commutators attached to a 750-kw rotary converter is shown in the accompanying illustration. The grinder is installed by unloosening the bolts of the bearing cap and inserting a pair of angle irons between the cap and the pedestal. After tightening the bolts again, the slides for the grinder are bolted to the angle irons. When the distance between adjacent brush sets is small, as is the case with fifty-cycle rotary converters, it is necessary to remove one set of brushes. In the illustration the second set has been removed so as not to obstruct the view of the grinding wheel. In special cases this grinder can be used when the machine is in operation; for this operation an insulated grinding wheel is used.

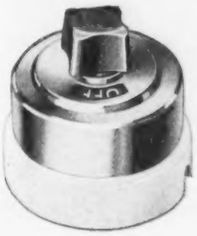


LONG-SNOUT COMMUTATOR GRINDER

This grinding machine is being made by the Witton-Kramer Electric Tool & Hoist Company, Ltd., Witton, Birmingham, England, for which the General Electric Company, 67 Queen Victoria Street, London, England, is sole selling agent.

Snap Switches

Single-pole, double-pole, three-point, four-point, two-circuit electrolier and three-circuit electrolier snap switches are being placed on the market by the Manhattan Electrical Supply Company, 17 Park Place, New York. The outside diameter of the bases of all these switches is 2 in., and holes for the supporting screws are 1 7/16 in. between centers. The ratchet and the



SINGLE-POLE SNAP SWITCH

parts connected to it are attached to the base in such a way, the manufacturers claim, that they cannot become loose or detached in operation. The spring washer on the back of the swivel is constructed so as to take up any wear of the inner switch mechanism resulting from long use. The blade is solidly riveted to the commutator. The driving spring is of large diameter. The brushes are held by flat washers with rectangular holes and are staked in one solid piece. The binding-post screw hole is punched so as to produce a collar which adds to the number of threads through which the screw shank passes. In the illustration herewith is shown a single-pole snap switch with a solid base.

Electric Crane Controller with Safety Lock

Magnet-switch controllers for single motors or for motors in series, used with cranes of the trolley, bridge or hoist type, are being made by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa. The

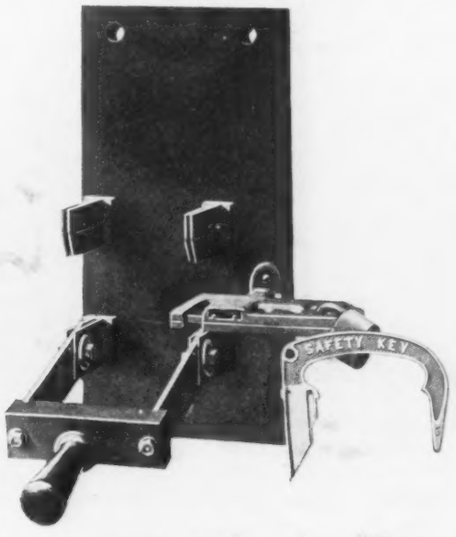


FIG. 1—SAFETY LOCK FOR CRANE CONTROL

magnet-switch contacts, it is claimed, cannot stick together, while the parts are few in number. The number of interlocks is reduced to a minimum. Each switch is equipped with an individual slate base, and the whole assembly is mounted on a pipe frame. Overload pro-

tection is provided by means of two overload relays (one on each side of the line). After the relays have operated, they are automatically reset by bringing the master switch to the "off" position. In order to secure

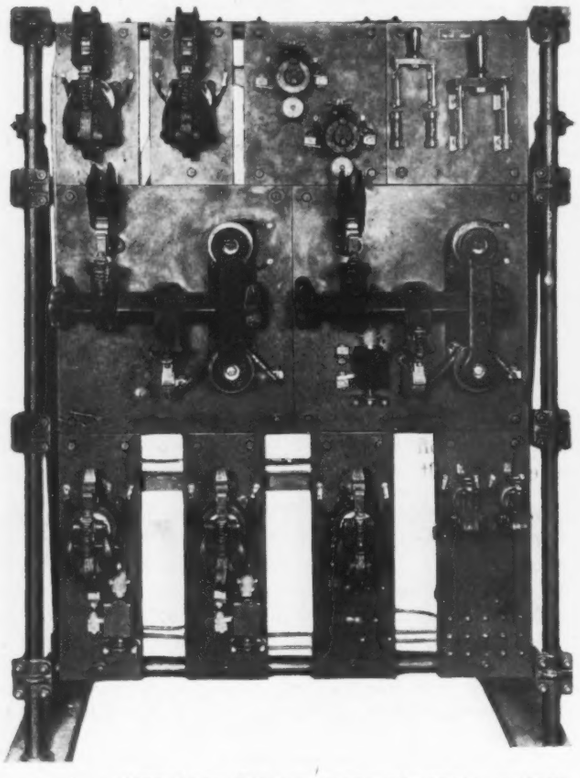


FIG. 2—CONTROLLER FOR USE WITH ELECTRIC CRANES

safety during inspection and repair of the crane apparatus, the device illustrated in Fig. 1 for locking the main-line switch is employed. The switch is kept open until the latter is replaced. Several holes are provided for padlocks.

Hot-Galvanized Conduit Bushings

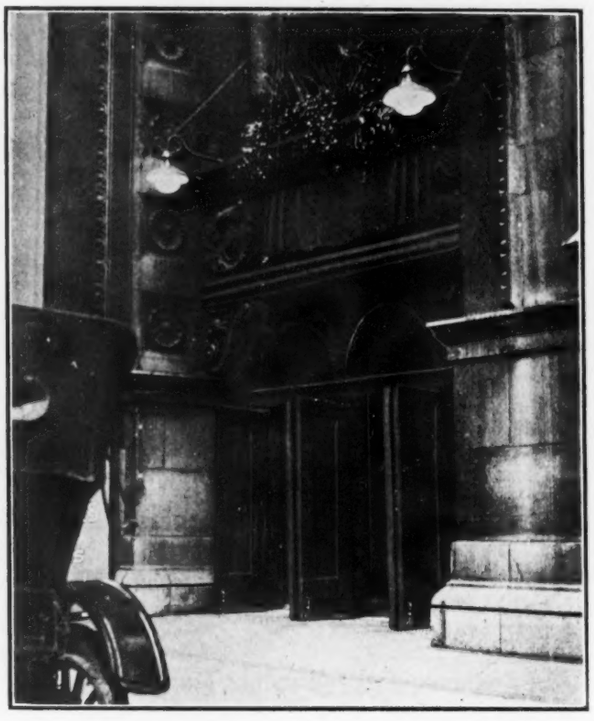
Hot-galvanized malleable-iron conduit bushings having a tensile strength of 37,000 lb. per sq. in. are being marketed by the Pittsburgh Valve & Fittings Company, Barberton, Ohio. Being hot-galvanized, these bushings will not rust. The iron used in the manu-

GALVANIZED CONDUIT BUSHING

facture of the fittings is melted in rectangular furnaces with natural draft so that it is possible to test and regulate the composition to obtain homogeneous chemical mixtures.

Entrance Lighting with High-Efficiency Lamps

Installed on each side of the main entrance to the central Y. M. C. A. building, Chicago, Ill., at a height of about 14 ft. above the sidewalk, is a 1000-watt nitrogen-filled tungsten lamp inclosed in a porcelain-enameled steel reflector of the diffusing-bowl type. The shades are supported by horizontal iron-pipe gooseneck fixtures and braced by chain guys. A 10-in. opal-glass diffuser incloses the lower half of each lamp bulb, thus concealing the filament from direct view. Venti-



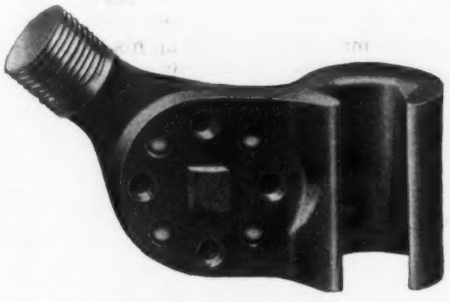
ENTRANCE OF CHICAGO Y. M. C. A. BUILDING, SHOWING ILLUMINATION BY MEANS OF NITROGEN-FILLED LAMPS

lator openings at the tops of the reflectors allow free circulation of air around the lamps.

The above described high-efficiency-lamp fixtures were furnished by the Federal Sign System (Electric), Lake and Desplaines Streets, Chicago.

Adjustable Conduit Hickey

The conduit hickey shown herewith is provided with four notches, two in each end, which, the manufacturers claim, prevents the tool from slipping. The tool is adjustable, and a new hold can be obtained by loosening



ADJUSTABLE CONDUIT HICKEY WITH NOTCHES TO PREVENT TOOL FROM SLIPPING

the nut and shifting the handle. It is made of crucible steel.

This "Anthony" conduit hickey, as it is called, is being made by M. B. Austin & Company, 700 Jackson Boulevard, Chicago, Ill.

Jobber, Dealer and Contractor

Fort Wayne Jobber to Take Better Quarters

Moving from its old home at 123 West Columbia Street, Fort Wayne, Ind., to the Fisher Building, diagonally across the same thoroughfare, the Protective Electrical Supply Company, of the city named, will have larger and better rooms. The new location, 130-132 West Columbia Street, gives the company the advantage of railroad siding facilities not enjoyed in the present location, so it is expected that handling of all shipments will be expedited and some saving may be effected on haulage. The building to be occupied is of brick and has 31,000 sq. ft. of floor space in its six stories and basement. Having secured an eleven-year lease of this building, the stock of the company will be moved about Jan. 1, 1915.

An Attractive Electric Appliance Shop

A small shop devoted exclusively to the marketing of electrical appliances, which was opened at Springfield, Mass., early in the present summer, has a number of distinctive features which deserve description. The store was installed by Mr. L. J. Kamper, an experienced electrical salesman and commercial manager, in the belief that the public would respond to the opportunity to deal with a specializing house, following the discontinuance of electric appliance sales by the local lighting company. No fixtures are carried, the stock being composed almost entirely of portable electrical conveniences used in the home, factory or business establishment. The store is located at 300 Bridge Street, close to the business center of Springfield, and has close relations with local contracting houses and the United Electric Light Company, although it is an entirely independent concern.

As the closing out of the appliance-sales business of the United company released a number of high-class store and office fixtures, the Appliance Shop took advantage of its opportunities and purchased among other things two handsome mahogany, plate-glass and marble display cases which are to be seen in the foreground of the accompanying photograph.

Over all, the store measures 39 ft. by 13 ft. 6 in. It is divided into a front or sales section, 23 ft. long, and a rear portion devoted to the carrying of stock, shipping and receiving. On a mezzanine gallery 16 ft. long and 6 ft. wide is located the manager's desk. The gallery commands a view of every part of the store while still being sufficiently removed from the main floor to enable the manager to carry on his desk work or to hold private conferences with visitors.

Instead of purchasing expensive cases to hold the stock in the rear of the store, the management made a deal with a local wooden-box factory by which boxes of ½-in. and ⅞-in. stock, 11 in. by 22 in. by 11 in. in dimensions, were utilized. Sixty-eight of these "unit boxes" have been set up on their sides at the rear of the partition separating the salesroom from the stock room, forming a flexible group of subdivided shelves at a cost of only 26 cents per box.

The main plate-glass display cases at the front of the store are each 3 ft. square and 6 ft. high. Two bay windows at the front are effectively utilized for exhibit, and behind the plate-glass cases on each side of the center aisle attractive displays of fans, heating devices, lamps, vibrators, washers, etc., are maintained. Variety is secured by the use of a 3-ft. by 8-ft. by 30-in. table on one side and of a 2-ft. 2-in. by 5-ft. by 3-ft. 6-in. case on the other, the salesroom attendant having a flat-topped desk at the rear, but in a location which commands a view of the main entrance. Several chairs placed in locations convenient to the display cases and table add to the comfort of patrons who may wish to examine goods at leisure. Six baseboard outlets, supplemented by two window outlets, enable appliances to be connected for demonstration in almost any part of the establishment. The lighting of the windows is accomplished by four 60-watt tungsten lamps in each case, mounted in metal reflectors at the top of the casing. The ceiling of the salesroom is 11 ft. 3 in. high, and the general illumination is provided by four 60-watt lamps mounted in a bowl-shaped Alberyl shade 18 in. in diameter, suspended by chains from the ceiling and carried about 8½ ft. above the floor.

Lamps and fans are sold by the shop through a co-operative purchasing agreement with local contracting interests, each house gaining the benefits of quantity discounts by purchasing on a single order. A number of last year's fans in excellent condition have been sold at the shop through the ability of the management to purchase the stock at reduced rates and to take these appliances off the hands of other houses which found them difficult to sell. The bookkeeping is kept up to the close of each day's business, loose-leaf records showing the cost and selling price of each article and furnishing the store with a continuous inventory. The system is maintained by a clerk in another establishment who gives a portion of her time to the appliance shop.

ELECTRIC-APPLIANCE SHOP AT SPRINGFIELD, MASS.

In its general furnishings the shop is characterized by light green walls, with a white ceiling having a fireproof metal lining. Grass matting and green rugs serve as floor coverings. Tea is frequently prepared electrically and served to patrons in the afternoon. Later in the season demonstrations of various electrical household appliances will probably be featured.

In its first few weeks of service the store has given every indication of filling a distinct place in the city's retail establishments, and its popularity is steadily increasing. The appliance delivery question is solved by an agreement with a local service starting from the same street, which makes a small flat rate per parcel within the Springfield district, this charge seldom exceeding 10 cents. Based on a low initial cost and operating expenses carefully graduated to the size of the store, the establishment bids fair to meet a definite demand for intelligent, specialized service, and it is one of the first shops of the kind not associated with a central station to be started in the East.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Trade Reports.—Bradstreets' reports electrical houses in Boston as having a better demand with collections somewhat improved. The electrical trade of Chicago, however, reports small orders, reduced profits and poor collections.

Southern Power Company.—It is reported from Charlotte, N. C., that, owing to the foreign situation, the Southern Power Company has postponed the letting of contracts involving several hundred thousand dollars' worth of equipment.

Kellogg Switchboard & Supply Company.—Construction has been started on the new $600,000 building at the corner of West Adams and Aberdeen Streets, Chicago, to be occupied by the Kellogg Switchboard & Supply Company. The company has taken a lease for twenty years.

Search-Lamp Sales.—During the last four or five weeks the Carlisle & Finch Company, of Cincinnati, Ohio, has sold the following search-lamps: nine 19-in., twelve 14-in., five 9-in. and four 7-in. With the exception of two 14-in. lamps for London and one 14-in. lamp for Montreal, the lamps were sold in this country.

Utah Power & Light Company Aids Farmers.—The company is bringing large tracts of land in Utah under irrigation by furnishing energy for the operation of pumps to lift water on lands where gravity irrigation cannot be used. The pumping plants are of all sizes, some irrigating thousands of acres and others lifting water for only a 40-acre farm. The largest district contains 40,000 acres.

Hartford Electric Light Company's New Home.—The company has moved into its new five-story building on Pearl Street. The building has a 130-ft. front and 110-ft. depth and is wholly fireproof. The company is to occupy the first four floors. A lecture hall, a reading and recreation room, a laboratory and a washroom equipped with shower baths are among the plans for the welfare of the employees. Besides housing the offices the building will contain display rooms, rest rooms, an electric cooking school shortly to be opened to the public, draftsmen's, engineers' and photographic rooms.

Electrical Equipment for Tannery.—Contracts for electrical generating and operating equipment in its Louisville (Ky.) plant have been let by the American Oak Leather Company to the Allis-Chalmers Company. These contracts represent an outlay of $20,000 and will give this tannery one of the largest installations of electrical equipment in the Louisville district. The purchases include two 250-kw generators, one 100-kw generator, and a number of motors rated at 500 hp in the aggregate. It had been the intention of the company to buy used machinery, but investigation of the market led it to invest in new equipment.

Production of Asbestos.—The production of asbestos in the United States is small, according to a bulletin recently issued by the Department of the Interior, United States Geological Survey, but in manufactured asbestos products the United States surpasses any other country. The total output of asbestos in this country for 1913 was about 1100 short tons, and all of it came from two producers in Georgia and one producer in Arizona. The world's supply of asbestos is drawn largely from the Province of Quebec, Canada, although the rapid development of the Russian industry is making that country an important factor in the world's supply. The bulletin also contains some interesting statements regarding the nature and composition of insulations containing asbestos placed on the market by various manufacturers.

Electrical Contracting Firms Consolidate.—The Court Electric Company, which was incorporated in April under the Massachusetts laws to do an electrical and contracting business, was absorbed on May 1 by the M. B. Foster Electric Company of Boston, and Mr. St. George and Mr. Quinlan were taken into the Foster company. The officers of the latter company are Mr. W. P. St. George, president; Mr. J. V. Quinlan, secretary, and Mr. M. B. Foster, treasurer. The Foster Electric Company is one of the largest electrical contracting companies in Boston and has completed contracts for work done throughout New England territory, in Canada, and as far west as Michigan. Included in these contracts is work in the Springfield municipal group of buildings, the Boston Opera House, the Wilbur Theater, the Children's Hospital and the Merchants' National Bank, all of Boston. Work is now being done by this company on the Boston City Club's building, the twelve-story Carpenter Building, the Brimmer School, and the Animal Hospital.

New Plant for Wire Company.—The Philips Insulated Wire Company, Pawtucket, R. I., will build a new plant which will be connected with the old establishment by tunnels across Freeman Street. The new power house will be about 100 ft. long, 60 ft. wide and 40 ft. high. The generating equipment will consist of two 600-kw, 550-volt, three-phase, 60-cycle turbo-generators made by the General Electric Company. Surface condensers made by the Wheeler Condenser & Engineering Company will be employed, using an Edwards air pump and a turbine-driven centrifugal pump made by the De Laval Company. The Barnard cooling tower will be 65 ft. high and will be operated by two fans, 10 ft. in diameter, running at 220 r.p.m. Steam will be furnished by eight 90-in. Manning boilers having a total rating of 2400 boiler-hp. The coal for the boilers will be stored in an underground pocket adjoining the entire length and one end of the power house for a distance of 170 ft. The switchboard equipment will be furnished by the General Electric Company. The new mill building will measure 200 ft. by 200 ft., and will be three stories high.

Slate for Electrical Equipment.—The Davis Slate & Manufacturing Company, 608 East Fortieth Street, Chicago, Ill., is in the market with a complete assortment of slate for electrical equipment. Although there are more than 100 active slate quarries in the United States from which it is said that "electrical" slate can be taken, the manufacturers above named claim that only about six of these quarries produce slate that will pass a reasonable test. The best slates for electrical purposes are said to be quarried in Monson County, Maine, and in Rutland County, Vermont. The former is a clear black slate and the latter is a clear purple slate. Both have practically the same insulation value and mechanical characteristics. The Monson slate has the advantage of a natural black color but it is much more expensive and more difficult to obtain than that taken from the Vermont quarries. The latter can readily be finished with a permanent dull-black lacquer in imitation of the Monson slate. Certain grades of Pennsylvania clear-black slate, when carefully selected, are satisfactory and are used to a considerable extent for low-voltage work, instrument bases, box linings, etc.

Sale of American Incandescent Lamps in Brazil.—According to the United States Consul-General at Rio de Janeiro, Brazil, Mr. Julius G. Lay, Dutch and German incandescent lamps have been replacing American lamps in the Brazilian market during the last few years, the principal reason being the lower prices at which European manufacturers are able to offer their products. While a certain type of American lamp, to yield the profit which local dealers are accustomed to receive, cannot be retailed at less than 42 cents to 45

cents each, the German and Dutch lamps cost but 27.5 cents each in large lots and retail for 32.3 cents. American lamps coming to the Brazilian market are usually packed separately in corrugated paper jackets and then in large wooden cases. The Dutch lamps are protected with similar corrugated paper jackets, but the packing case instead of being wood is a cardboard carton holding 100 lamps. While this packing is not so resistant as a wooden box, merchandise of this class is usually assigned on the Dutch line to a special part of the ship where it will not be crushed by heavier cases. There is no reason, according to Consul-General Lay, why American lamps should not be shipped in the same manner, and perhaps make it possible for American lamps to compete with European in this market.

Central-Station Business in the New England States.—The following data and comment regarding central-station business in the New England States may be compared with those for previous months appearing in the *Electrical World* of July 4 and June 6. Returns are now being received from over thirty operating utilities in that territory, but comparable data for previous months of this year are available for relatively few companies. Fortunately a majority of the large distributing systems of New England are among this number, and it is interesting to note the ebb and flow of monthly sales as shown in the records of these properties. Table I presents a comparison of gross income and energy output for each month from February to June, inclusive, 1914 and 1913, for eight large operating

TABLE I—NEW ENGLAND STATES—COMPARISON OF INCOME AND OUTPUT FOR FIVE INDIVIDUAL MONTHS, 1914 AND 1913, OF EIGHT LARGE COMPANIES

	Gross Income from Sale of Energy			Total Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
February	$1,197,778	$1,079,490	11.0	30,095,621	27,217,230	10.6
March	1,093,502	1,020,796	7.1	32,516,426	30,192,934	7.7
April	1,063,880	977,530	9.0	29,818,976	27,236,993	9.5
May	988,490	897,718	10.2	28,622,362	26,933,765	6.3
June	956,870	885,077	8.2	27,319,520	24,314,904	12.4

utilities; and it may be stated that between them these companies distribute approximately one-third of all the energy sold through lighting and motor-service meters in the New England field. The data for February, March and April have already been given in published tables, while those for May and June are presented here for the first time. It will be seen that the rates of increase shown by the returns for the summer months are maintaining the values which were derived from the earlier data, and that good gains are still being registered on both income and output. The rate of increase on revenue from the sale of energy has varied between 7.1 and 11 per cent over the five-month period; while the energy marketed has never shown less than 6.3 per cent increase, and has gone as high as 12.4 per cent for the month of June. The figures for output provide, of course, a fairly direct reflection of the condition of the energy-consuming industries to whose demand the central stations are ministering. While it is impossible to discredit all that is heard regarding the slackness now prevalent among many of the New England industries, the evidence of these figures cannot well be refuted. The companies included in Table I embrace the urban distributing systems in the cities of Boston, Worcester, Cambridge, New Bedford, Lynn and Springfield, Mass.; Providence, R. I., and Hartford, Conn. In communities such as these the residence-lighting load, after all, is not capable of swaying the total station output to the same extent as the motor-service demand, and the table shows that there is a demand on the stations in 1914 at least 10 per cent greater than last year. Industrially, therefore, New England cannot be standing still, at least so far as its major cities are concerned; although it may be noted that for the five-year period covered by the last two government censuses there was a demonstrated annual average increase in central-station output of over 17 per cent. In the smaller New England communities such good gains as the foregoing are not now being recorded. In addition to the figures for the eight large companies regarding whose business comparable returns

TABLE II—NEW ENGLAND STATES—COMPARISON OF INCOME AND OUTPUT FOR APRIL AND MAY, 1914 AND 1913, OF ALL COMPANIES REPORTING TO ELECTRICAL WORLD

	Gross Income from Sale of Energy			Total Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
April (33 companies)	$1,501,773	$1,384,255	8.5	43,386,624	39,181,988	10.8
May (41 companies)	1,745,160	1,609,234	8.4	52,752,247	50,779,103	3.9

are available for each month from February to June, the *Electrical World* has received reports for the month of May from some thirty-three further utilities, most of them from the smaller towns and cities, although a few of them relate to such considerable systems as those of Manchester, N. H.; Waterbury, Conn., and Portland, Maine. These additional data show that there is a materially lower rate of increase over 1913 among the New England communities of 30,000 population and less. In the aggregate it is found that the gross income of these thirty-three utilities increased from $711,516 in May, 1913, to $756,670 in May, 1914, or at a rate of 6.4 per cent; while the energy output of stations increased in the same time from 23,845,338 kw-hr. to 24,129,885 kw-hr., or at a rate of only a little more than 1 per cent. Most of these companies are handling from $10,000 to $30,000 of gross sales in the month, and among the thirty-three utilities there are to be found four instances of decreasing revenue. Seven of the companies distributed less energy in May, 1914, than in the same month last year; so that, so far as the smaller towns are concerned, it cannot be said that the figures for electrical demand (which should be a good criterion) indicate any notable increase in industrial activity in the New England States. The combined totals for April and for May for all the companies reporting to the *Electrical World* are shown in Table II. At the present time the June reports for the whole territory are not available, and no inclusions are therefore made for that month. Data for June, supplementary to the figures shown in Table I, will be given in a later issue. Meanwhile it may be noted that the May figures cover an output of energy in excess of the fifty-million mark; and, as nearly as can be estimated, the output of the entire central station industry of New England did not exceed 85,000,000 kw-hr. for the month.

NEW YORK METAL MARKET PRICES

	July 28 Bid	July 28 Asked	Aug. 4 Bid	Aug. 4 Asked
Copper				
Standard spot*	....	13.00	.....	.....
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard spot*	58 5 0		.. .. ..	
Prime Lake	13.25	to 13.37½	12.75	to 12.87½†
Electrolytic	13.00	to 13.12½	12.50	to 12.75†
Casting	12.87½	to 13.00	12.37½	to 12.50†
Copper wire base	14.37½	to 14.62½	14.00	to 14.25
Lead	3.90		3.90	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	7.00		7.00	
Spelter, spot	5.05	to 5.15	4.90	to 5.00
Tin, spot*	30.60	to 31.00	.....	to .....
Aluminum:				
Prompt delivery	17.37½	to 17.62½	19.00	to 20.00
Future	17.37½	to 17.50	.....	to .....

***COPPER EXPORTS**

Total tons to August 4 3,053

*From daily transactions on the New York Metal Exchange.
†Nominal.
NOTE.—The New York Metal Exchange and the London Metal Exchange have been closed until further notice. No reliable quotations on old metals can be obtained for the present. There is no buying in this market.

Corporate and Financial

United Electric Securities Company.—The company has asked tenders until Aug. 11 on as many of its collateral-trust 5 per cent bonds of the twenty-first series as $23,412 will purchase, on as many of the twenty-fifth series as $53,728 will purchase, and on as many of the twenty-eighth series as $73,697 will purchase, making a total of $150,838. Bonds accepted will be paid for Aug. 13 with accrued interest.

Columbus Railway, Power & Light Company.—The company's plan for financial reorganization, as described in the *Electrical World* of June 13, was practically completed at an adjourned meeting of the stockholders. The shareholders by over a three-fourths majority voted in favor of an increase of the capital stock of the company from $11,550,000 to $15,145,000. The company is operated by E. W. Clark & Company, of Philadelphia.

Hannawa Falls Water Power Company.—The Public Service Commission of the Second District of New York has authorized the Hannawa Falls Water Power Company to purchase a controlling interest in the stock of the Northern Power Company, through which the Hannawa Falls Company has for a long time been disposing of much of its energy. The Hannawa Falls company has hitherto been engaged in the wood-pulp industry.

A Select List of Public Utility Investments.—H. F. McConnell & Company, of New York, have issued a forty-four-page booklet entitled "Select List of Public Utility Investments." In all, forty companies are described as to their history, industry and financial standing. The last few pages are taken up with an interesting history of the development of the gas industry, eighteen ways in which one cent's worth of electrical energy can be used and a table showing the approximate yield of stocks paying from 2 to 9 per cent.

Dayton Power & Light Company Earnings.—The earnings of the Dayton (Ohio) Power & Light Company for the six months ended June 30 show a very encouraging increase over the same period in 1913, the earnings for some months showing an abnormal increase, largely due to the effects of the flood in the spring of 1913. The surplus for the six months, after deducting preferred dividends and interest charges, is $49,225. On this basis the company is earning about 3 per cent on $3,500,000 common stock.

Annual Report of American Light & Traction Company.—The earnings statement for the year ended June 30, 1914, shows gross earnings of $4,415,611, made up of $3,697,743 as earnings on stocks of subsidiary companies owned by the parent company and of $717,868 as miscellaneous earnings. Expenses amounted to $139,466, leaving $4,276,145 as net earnings. Surplus earnings and reserve from 1913 were $8,973,146, making $13,249,291 as total surplus earnings. From this is to be deducted $3,671,627 for dividends both cash and stock. This left the surplus balance as $9,577,664.

Auglaize Power Company Meeting.—A meeting of the stockholders of the Auglaize Power Company will be held in the company's offices, Spitzer Building, Toledo, Ohio, Aug. 15, to vote on the proposal to issue two kinds of stock. In place of the $1,000,000 common stock, the stockholders will be asked to authorize $666,600 preferred stock, to be disposed of as the directors may decide, and $333,400 common stock in shares of $100 each. The stockholders will be asked also to authorize the directors to borrow not more than $200,000 on promissory notes at 6 per cent interest, maturing on or before five years from date, the interest to be paid semi-annually.

Electric Light & Power Company of Abington and Rockland.—A special meeting of the stockholders has been called for Aug. 10 for the purpose of authorizing an additional issue of $47,200, par value, of capital stock. The Board of Gas and Electric Light Commissioners approved of this issue on July 21 and fixed the price at $140 per share. The holder of each share of present capital stock may subscribe for one-fourth of a share of the new stock if the issue is authorized. The proceeds from the sale, if the issue be approved, are to be devoted to paying a part of the floating indebtedness, which now amounts to $110,000. The company is under the management of Stone & Webster.

First Annual Report of Alabama Traction, Light & Power Company, Ltd., Montreal.—The income statement for sixteen and three-quarter months ended Dec. 31, 1913, shows a net income from operating subsidiaries, before providing for depreciation but after deducting $84,523 for interest on funded and floating debt, of $93,133. President James Mitchell in speaking of the business said that while for a time it was disappointing, it is now showing a satisfactory progress. Among the new developments of the company was the completion of the dam on the Coosa River, the placing in operation of the first of the four 17,500-hp units, and the putting in service of a reserve steam plant with a rating of 15,000 hp.

United States Light & Heating Company Statement.—Mr. A. H. Ackerman, vice-president and general manager prior to the receivership and retained as general manager under the receivership, has issued from the home office at Niagara Falls, N. Y., the following statement: "The action recently sustained in the appointment of the receivers for the property of the company was a necessary step to conserve the assets for the benefit of all. With assets of three dollars for every dollar of debt, the company is amply stable, and the court's direction to continue the business is the last proof necessary to reassure the buying public. There are already under way plans for broad financing, and with the return of general prosperity in the country the company, more aggressive than ever before, intends to secure its own full share of the business and to continue the manufacture and sale of its special electrical products."

Bankers' Novel Illustration.—Messrs. William P. Bonbright & Company, of New York, in their "Fortnightly Review" declared that "investors generally are beginning to realize the advantages of public utility securities as to safety of principal and interest return. We venture to say, however, that comparatively few even among those who specialize in them, are familiar with the physical features of a hydroelectric plant." To supply this information the publishers have prepared in the paper a diagrammatic sketch of a hydroelectric development with an index designating the parts. The illustration is 7¾ in. by 5⅜ in. Starting with the storage reservoir, the path of the water is traced through the turbines into the tailrace. From the power house the lines go out, tying the residential part of a town to the business section. Substations are shown with their transformers and converters. The illustration also shows a steam reserve plant with all of its important details. To make the illustration more realistic even such details as insulators, trolley feeders, distribution lines, lighted lamps, trolley cars and natural scenery are pictured.

Cities Service Company Defers Dividends.—The following announcement has been made by the directors of the Cities Service Company: "While hopeful that a general European war will not take place, that the acute conditions which now prevail in all the financial centers of the world will grow no worse, and that normal conditions will soon be established, the directors feel that every precaution should be taken to protect the interests of the company in event the worst should happen. The board has decided, therefore, to defer payment of dividends, including those due Aug. 1, on the preferred and common stock of the Cities Service Company, to the end that the best interests of the corporation and its stockholders may be protected during this period of world-wide financial cataclysm." In a letter to the stockholders the directors said in part that "unless a decided change for the better occurs it may be some time before normal financial conditions will prevail, and all requirements of the company may have to be met from the net earnings of the subsidiary companies. The earnings of these companies are entirely satisfactory, and we expect them to so continue. Your directors feel that all cash resources of the company should be conserved. They hope for an immediate change for the better which will insure a speedy return to normal conditions and enable cash dividends to be resumed. In their decision they are also mindful of the present practically prohibitive rate of exchange, applying at this moment to dividend payments abroad." Another meeting has been called for Aug. 7 to consider further the matter of dividends. The directors will send a weekly letter to the stockholders as long as the unsettled period continues.

Business Notes

The Niagara Searchlight Company, of Niagara Falls, N. Y., has transferred its sales office to New York City. A. Hall Berry, 97 Warren Street, will be exclusive general sales representative.

Albrecht F. Leue, advertising manager for the Triumph Electric Company, Cincinnati, Ohio, has tendered his resignation, effective Aug. 1, when he will begin the practice of law in Cincinnati.

P. & B. Manufacturing Company, Inc., of 306 Manufacturing Home Building, Milwaukee, Wis., will manufacture electrical fittings and heating appliances. H. H. Petersen is secretary and treasurer.

The Terry Steam Turbine Company, builder of steam turbines, Hartford, Conn., announces that it has appointed Fidanque Brothers & Sons, of New York and Panama, with main office at 15 Whitehall Street, New York City, as its representatives for the republic of Panama and the Canal Zone. The company also announces that on Aug. 1 its Cleveland office, in charge of Mr. L. G. Finlay, was moved from its former location, 710 New England Building, to 503 Union Building, Cleveland, Ohio.

The Stromberg-Carlson Telephone Manufacturing Company has been reincorporated, taking over all the property and assets of the old company of the same name. The new company has substantially the same officers and employees as the old company and will continue in the business of supplying switchboard equipment, telephone and other associated electrical devices. The company's headquarters are at 1050 University Avenue, Rochester, N. Y., and it has branches in Chicago, Toronto, San Francisco and Seattle and agency arrangements in British Columbia and on the Pacific Coast with the Telephone Electric Equipment Company and in Manitoba, Saskatchewan and Alberta with Messrs. Houston & Company, Ltd. The officers are: F. N. Kondolf, president; F. C. Goodwin, vice-president; W. R. McCanne, treasurer and general manager, and W. M. Angle, secretary.

New Industrial Companies

The Electric City Glass Company, of Buffalo, N. Y., has been incorporated with a capital stock of $35,000 by A. and O. A. Tresch and C. F. Wagner, of Buffalo, N. Y.

The Federal Lighting Fixture Company, of Buffalo, N. Y., has been incorporated with a capital stock of $5,000 to do general electrical work. The incorporators are J. M. Morrell, E. T. and J. G. Irr.

The Fruiser Electric Motor Manufacturing Company, of Rochester, N. Y., has been incorporated by H. R. Howard, R. C. Cash and Lillian Weyrauch. The company proposes to manufacture motors, machinery, etc.

The C. W. Elevator Company, of New York, N. Y., has been chartered by C. V. Cheesman, 153 Greene Street, New York, N. Y.; S. Weinschenk and E. Eble, of New York, N. Y. The company proposes to do a general electrical engineering business.

The Horton & Williams Electric Company, of Gary, Ind., has been incorporated by George W. Horton, of Gary, Ind.; H. B. Williams and N. H. Williams. The company is capitalized at $10,000 and proposes to manufacture and install electrical apparatus.

The United States Train Signal Company, of Portland, Maine, has been incorporated with a capital stock of $1,000,000 to manufacture and deal in signals, etc. The officers are W. E. Benn, of McAdam Junction, N. B., and W. B. Hall, of Portland, Maine.

The Trenaman Electric Dental Manufacturing Company, of New York, N. Y., has been incorporated with a capital stock of $50,000 to manufacture dental apparatus, etc. The incorporators are: J. V. Trenaman, T. F. Diack and J. J. Page, of New York, N. Y.

The Decker Manufacturing Corporation, of Brockport, N. Y., has been incorporated with a capital stock of $26,200 to manufacture and deal in hardware, heating apparatus and lighting fixtures. The incorporators are Charles Decker, H. Holmes and M. M. Decker, of Brockport.

The Cooper Flexible Transmission Company, of Brooklyn, N. Y., has been chartered with a capital stock of $160,000 by S. C. Yoemans, B. C. Holt and H. Cooper, 618 Sixty-fifth Street, Brooklyn, N. Y. The company proposes to manufacture devices for transmission of power, etc.

The Federal Automatic Safety Device Company, of New York, N. Y., has been granted a charter with a capital stock of $100,000 for the purpose of doing a general mechanical and electrical engineering business, manufacturing tools, etc. The incorporators are E. T. Moore, of Passaic, N. J.; E. W. Gray, of Newark, N. J., and J. F. S. Moore, of New York, N. Y.

The Lamson Spindle Company, of Dover, Del., has been incorporated with a capital stock of $6,000,000. The company proposes to manufacture and deal in engines, motors, dynamos, tools and surgical instruments of all kinds; to do a general chemist and druggist business and to acquire, own and develop mineral lands of all kinds. The incorporators are M. M. Hirons, Charles H. Butler, W. I. N. Lofland and W. F. P. Lofland, all of Dover, Del.

Trade Publications

Glass Sterilizer.—An electrically heated glass sterilizer is described in a folder issued by the Quick Electric Heater Company, Cincinnati, Ohio.

Washing and Wringing Machines.—The Economy electric washing and wringing machine is described in a folder sent out by the Pittsburgh Gage & Supply Company, Pittsburgh, Pa.

Lighting System.—An advance announcement concerning its 12-volt lighting system has been made by the Bosch Magneto Company, 223 West Forty-sixth Street, New York City.

Electrolier Sockets.—Weber universal electrolier sockets with keys and pull-chains are described in a folder distributed by the Weber Electric Company, 143 Liberty Street, New York City.

Rigid Conduit.—Card No. 10 issued by the Safety-Armorite Conduit Company, Pittsburgh, Pa., contains prices and discounts offered distributers on rigid conduit of the galvanized and enameled type.

Snap Switches.—Snap switches with handles specially adapted to finger grip are described in a folder being distributed by the Manhattan Electrical Supply Company, 17 Park Place, New York City.

Alternating-Current Instruments.—Switchboard-type alternating-current voltmeters, ammeters and wattmeters are described in a catalog issued by the Kernel Apparatus Company, Cambridge, Mass.

Ball Bearings for Motors.—The S K F Ball Bearing Company, 50 Church Street, New York City, has published a thirty-eight-page pamphlet showing applications of ball bearings to various types of motors.

Fixtures for Nitrogen-Filled Lamps.—Supports, sockets and reflectors for nitrogen-filled lamps are described in a folder published by the Federal Sign System (Electric), Lake and Desplaines Streets, Chicago, Ill.

Indicating Fuse Plug.—A fuse plug which will give an indication, even in the dark, when it has been blown is illustrated in a leaflet published by the Premier Electrical Manufacturing Company, Bridgeport, Conn.

Rotary Water and Air Pumps.—Centrifugal water and air pumps and rotary jet condensers manufactured by the Manistee Iron Works Company, Manistee, Mich., are described in a catalog just issued by that company.

Terminal Tool.—A device for making permanent and positive terminals on electric wires and flexible cables is described in a booklet issued by the Bosch Magneto Company, 223 West Forty-sixth Street, New York City.

Lightning and Lightning Protection.—Reasons for protective apparatus failing to ward off lightning, accounts of the action of lightning and descriptions of protective installations are given in booklets prepared by the National-Standard Company, Niles, Mich., and W. C. Shinn, Lincoln, Neb.

Personal Mention

Mr. Charles N. Hebner has resigned as secretary of the Illinois Public Utilities Commission.

Mr. Charles Hurmense has been appointed manager of the Sumner (Iowa) Light & Power Company.

Mr. A. W. Cowles has been appointed purchasing agent of the Agawam (Mass.) Electric Company.

Mr. J. F. Perkins has been appointed purchasing agent of the Public Service Company, St. Cloud, Minn.

Mr. A. Boyd has been appointed superintendent of the Glasgow (Ky.) Electric Light & Ice Company.

Mr. L. M. Balzer has been appointed superintendent of the Bettendorf (Iowa) Improvement Company.

Mr. H. H. Heinze has been appointed purchasing agent of the Freeport (Ill.) Railway & Light Company.

Mr. Charles Thomas has resigned as superintendent of the Martinsville (Ind.) Gas & Electric Company.

Mr. J. E. Hensley has been appointed purchasing agent of the Alcorn Electric Light Company, Corinth, Miss.

Mr. Bert Streeter has succeeded Mr. John Feagans as vice-president of the electric works, Washington, Ind.

Mr. L. A. Nickell has been appointed manager and secretary of the Brunswick (Mo.) Light & Water Company.

Mr. H. D. Pole has been appointed superintendent of the Virginia-Western Power Company, Ronceverte, W. Va.

Mr. Fred J. MacLeod was elected chairman of the Massachusetts Public Service Commission at the reorganization meeting held in Boston July 31.

Mr. E. Doughty has been appointed superintendent of the municipal electric plant at Atlantic Highlands, N. J., as successor to Mr. Henry G. Bennett.

Mr. J. M. Smith, for many years electrical engineer with the Crocker-Wheeler Company, Ampere, N. J., and manager of the engineering department since 1911, on Aug. 1, 1914, became associated with the Triumph Electric Company, Cincinnati, Ohio.

Mr. W. Z. McBride, manager of the Vacaville (Cal.) Water & Light Company, was shocked and burned by a 2200-volt wire while repairing an arc lamp in the absence of a lineman. Mr. McBride recovered after being confined to his room for a week.

Mr. Edward L. Cox, who has been appointed manager of the lighting division of the electrical department, H. W. Johns-Manville Company, Madison Avenue and Forty-first Street, New York, was formerly with the Enos & Watkins Company, New York, for eighteen years.

Mr. W. P. Dobson has been appointed director of the experimental laboratories of the Ontario Hydro-Electric Power Commission at Toronto. For the last eighteen months he has been carrying on research work on electrical disturbances in high-tension transmission systems for the University of Toronto Engineering Alumni Association.

Mr. G. Eugene Villaret, who is now in charge of lighting-fixture design with the H. W. Johns-Manville Company, Madison Avenue and Forty-first Street, New York City, was fourteen years with the Thackara Manufacturing Company, Philadelphia, Pa., and during the last ten years has been connected with the Cassidy & Son Manufacturing Company, New York. He received his preliminary training at the Ecole des Beaux Arts, Paris.

Mr. George W. Elliott has resigned as advertising manager of the McGraw Publishing Company, publisher of the *Electrical World.* Mr. Elliott joined the business staff of the *Electrical World* in 1896 and continued as advertising representative until November, 1912, when he was appointed advertising manager of the McGraw Publishing Company and elected a member of the board of directors. With the relaxation of active duties Mr. Elliott plans to take a vacation in Europe.

Mr. Ernest E. Lee has resigned as superintendent of erection of the department of maintenance, Isthmian Canal Commission, and has returned to Evansville, Ind. Mr. Lee, a former employee of the Commonwealth Edison Company of Chicago, joined the Panama Canal engineering staff in 1907 and was placed in charge of the preparation of designs for the lock machinery and the Atlantic and Pacific generating stations. Later he was promoted to be assistant electrical and mechanical engineer, and in 1911 he was appointed superintendent of erection of operating machinery and electrical equipment for locks, spillways, the Gatun hydroelectric station, substations and transmission line.

Mr. E. C. Deal has been appointed to succeed Mr. J. P. Clark as vice-president and general manager of the public-utility properties controlled by W. N. Coler & Company, New York City, among which are the North Carolina Public Service Company and the Salisbury & Spencer Railway Company, Greensboro, N. C. Mr. Deal's new headquarters will be at Greensboro. Mr. Deal received his first engineering experience with the Georgia Electric Light Company of Atlanta. Later he was employed in various positions in different parts of the country with public-service properties operated by the Stone & Webster Management Association. In 1904 he left this organization and became associated with W. N. Coler & Company as chief engineer of the Gas & Electric Company of Bergen County, N. J. When this system was absorbed by the Public Service Corporation of New Jersey he was appointed superintendent of the Bergen division and later of the central division. In 1908 he resigned and became general manager of the Carolina properties of W. N. Coler & Company. Three years later he again left the Coler company and went with the J. G. White Company, Inc., as general manager of the Augusta Railway & Electric Company and the Augusta-Aiken Railway & Electric Company. These companies were later merged into the Augusta-Aiken Railway & Electric Corporation, Mr. Deal continuing as general manager. In 1913 he became vice-president and general manager of the company and early in the present year again resumed his connection with W. N. Coler & Company. For sixteen years Mr. Deal has been active in the National Electric Light Association and at its Chicago convention of 1913 was elected fourth vice-president. In 1913 he also served as president of the Southeastern Section of the N. E. L. A.

E. C. DEAL

Obituary

Charles H. Cooke, who had been recently associated with plans to develop the water-power of the Delaware River, died at New York, Aug. 1, at the age of sixty-seven. Mr. Cooke was from 1883 to 1886 engaged in general office and field work for the old Edison Electric Lighting Company, and after holding a number of civil-engineering positions became chief engineer of the Needel Mountain Electric & Power Company of Colorado in 1897. The last fifteen years of his life had been given to the Delaware River project.

John B. Allan, for many years an authority on steam-engineering practice in the Middle West, died at his home at Oak Park, Ill., July 28. Mr. Allan was born Jan. 14, 1860, at Davenport, Ia., and received his early education in Muscatine, Ia. In 1882 he was graduated from Worcester (Mass.) Polytechnic Institute and entered the employ of the Edward P. Allis Company, of Milwaukee, where he rose steadily until he was assistant to the chief designer. Gaining shop and erecting experience, he was sent to Chicago in 1886 to open the company's first sales office. Later he was made manager of sales for the engine department of the entire Edward P. Allis Company. Upon the organization of the Allis Chalmers Company he was made vice-president and general manager, in which position he remained until he accepted the position of Western general sales manager for the Westinghouse Machine Company in 1907. Here he remained for three years until failing health prompted him to give up his active work.

Construction

New England

PHILLIPS, MAINE.—The electric plant of the Phillips El. Lt. & Pwr. Co. was destroyed by fire recently.

BRADFORD, VT.—The Bradford El. Ltg. Co. is reconstructing its Bradford village line. A. F. Dickey is assistant manager.

BOSTON, MASS.—Bids will be received by the trustees of the Boston City Hospital until Aug. 12 for changes and additions to the electric wiring of east and west pavilions, domestic and laundry buildings, South Department. Proposal blanks may be obtained at the office of Joseph McGinness, 112 Water Street, Boston, where drawings and specifications may be obtained upon deposit of $5, to be refunded upon return of same.

GARDNER, MASS.—The contract for supplying electricity to the State prison camp at West Rutland has been awarded to the Gardner El. Lt. Co. Work will soon be started on the erection of a 2-mile transmission line. The two gas engines now used at the camp will be replaced with electric motors.

HAVERHILL, MASS.—The Haverhill El. Co. is contemplating placing all its wires on Essex and Wingate Streets in underground conduits.

LEXINGTON, MASS.—The citizens have voted to authorize the Selectmen to make a contract with the Edison El. Illg. Co. to install 46 lamps of 100 cp to replace the 22 lamps of 60 cp on Massachusetts Avenue, from Grant Street to and including the Common.

NORTH ABINGTON, MASS.—The El. Lt. & Pwr. Co. of Abington & Rockland, of North Abington, has called a meeting of the stockholders to be held on Aug. 10 to vote on the proposal to increase the capital stock by $47,200.

SPRINGFIELD, MASS.—The City Supervisors have given their approval of the new ornamental lamp standards submitted by the United El. Lt. & Pwr. Co. It is understood that the company will place contract at once for about 400 standards.

PASCOAG, R. I.—The Pascoag Fire District has been given permission to erect transmission line on the highways in the village of Harrisville.

Middle Atlantic

BELLEVILLE, N. Y.—The Public Service Commission has approved the construction of an electric plant and transmission lines and the exercise of a local franchise by Harlow E. Ralph in Belleville.

ROCHESTER, N. Y.—The Town Board of Greece has decided to install electric lamps at Grand View Beach to replace the oil lamps now in use. Twenty-five lamps will be installed. The Rochester Ry. & Lt. Co. furnishes electrical service in Greece.

ROCHESTER, N. Y.—The Public Service Commission has granted the Rochester Tel. Co. permission to issue $100,000 in bonds, the proceeds to be used for construction of a new central office in Rochester for the "Northwest" exchange and for various lines in connection therewith.

WESTFIELD, N. Y.—At the special election held July 25 the proposal to issue $7,100 for repairs and improvements to the municipal electric-light plant was carried.

BOYERTOWN, PA.—Preparations are being made by the Boyertown El. Co. for the installation of a 500-hp engine and generator in the part of the building now used for an office.

CONNELLSVILLE, PA.—A movement has been started by the merchants on Pittsburgh Street for the installation of an ornamental lighting system.

ELLWOOD CITY, PA.—Preparations are being made by the electrical committee of the Borough Council to extend the street-lighting system through Hazel Dell as soon as that district is taken over by Ellwood City. It is also proposed to extend the lines to furnish residential and commercial lighting service.

GETTYSBURG, PA.—The Town Council has adopted a resolution providing for the installation of a municipal electric-light plant; also to engage an engineer to prepare plans and estimates for same.

MEDIA, PA.—The electric light committee expects to purchase within the next 30 days 25 nitrogen-filled lamps of 700 cp, and within the next two months 35 poles, glass insulators and some No. 6 wire. Preliminary plans have been prepared for the installation of an additional engine, generator, boiler and new filtration system, but have not yet been approved by the Councils. P. E. Ahern is superintendent.

PHILADELPHIA, PA.—The Board of Education is contemplating the installation of an electric-light plant, refrigerating plant, a vacuum-cleaning system and ventilating system in the new Frankford High School.

PHILADELPHIA, PA.—The Fairmount El. & Mfg. Co., it is reported, will soon ask for bids for the construction of a two-story factory building, 45 ft. by 100 ft., to be erected at Fifty-ninth Street and Woodland Avenue.

PHILADELPHIA, PA.—A permit has been issued for the erection of a power house for the Philadelphia El. Co. on the south side of Christian Street, east of Schuylkill Avenue, to cost $1,000,000. The building will be equipped with two turbo-generators, one of 30,000 kw and the other of 35,000 kw. Contract for construction of building has been awarded to the Fidelity Construction Co. The plant when completed, it is understood, will furnish electricity to operate the Pennsylvania Railroad lines from Broad Street Station to Paoli. John T. Windrim is architect.

POTTSVILLE, PA.—The Reading Coal & Iron Co., it is reported, is considering the erection of a power station in Pottsville to furnish electrical energy in the Schuylkill Valley.

BORDENTOWN, N. J.—The installation of a municipal electric-light plant is under consideration by the Citizens' League and the City Commission. The cost of the plant is estimated at $40,000.

BUTLER, N. J.—The Council has engaged Frederick O. Runyon, electrical engineer, of Newark, as consulting engineer in connection with the establishment of a municipal electric-light plant, for which $30,000 in bonds was recently voted.

ELIZABETH, N. J.—The Singer Mfg. Co., manufacturer of sewing machines, is reported to be contemplating the construction of a new power station at its manufacturing plant.

KEYPORT, N. J.—The Middlesex-Monmouth Lt., Ht. & Pwr. Co. has petitioned the Board of Freeholders for permission to erect a transmission line from Whale Creek to South Amboy.

WOODBOURNE N. J.—Arrangements are being made by the Woodbourne El. Co., of Sussex, for the installation of a 150-hp boiler.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until Aug. 17 for furnishing the following supplies under Proposal 710: Six standard oil equipments complete for switchboard room, 300 5-in. steel side-cutting pliers, 50 4½-in. nickeled tweezers, 2000 ft. 1-in. conduit, 100 ft. 1¾-in. conduit and 100 ft. 2¼-in. conduit.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 21 for furnishing and installing lighting fixtures in the United States custom house at Boston, Mass.; the United States post office at Minneapolis, Minn.; the United States post office and court house at Muskogee, Okla., and the United States sub-treasury at San Francisco, Cal., in accordance with plans and specifications, copies of which may be secured at the above office. For details see proposal columns.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 18, for furnishing at the various navy yards and naval stations supplies as follows: Charleston, S. C., Schedule 7094—1400 lb. 2-in. and 2¼-in. copper pipe, 2100 lb. miscellaneous brass pipe; Schedule 7092—7100 ft. black and galvanized wrought-iron pipe. Boston, Mass., Schedule 7094—Miscellaneous drawn, seamless copper pipe (16-in. lengths); Schedule 7092—Miscellaneous galvanized and black wrought-iron pipe. Newport, R. I., Schedule 7100 — Miscellaneous black wrought-iron pipe, standard weight; Schedule 7102—5700 lb. hard-drawn, torpedo bronze tubing, 2000 lb. hard-drawn and annealed copper tubing. Bids will also be received at the same place until Aug. 25 as follows: Mare Island, Cal., Schedule 7099—650 cutout plug and inclosed fuses, miscellaneous drawn, seamless copper pipe (12-ft. lengths), miscellaneous cold-rolled finished steel (15-ft. lengths), 6500 evaporator and condenser tubes, miscellaneous engineers' wrenches (semi-finished single, open end, milled openings). Brooklyn, N. Y., Schedule 7081—26 3-hp. 230-volt turret turning motors and equipment and spare parts; Schedule 7082—One windlass anchor, with two 230-volt direct-current motors and spare parts. Puget Sound, Wash., Schedule 7096—9000 ft. ¾-in. diameter, plow-steel flexible wire rope. Applications for proposals should designate the schedule desired by number.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 25 for furnishing at the various navy yards and naval stations supplies as follows: Philadelphia, Pa., Schedule 7111—for furnishing and erecting one centrifugal air compressor set. Brooklyn, N. Y., Schedule 7113—eight variable speed gears, type C, including spare parts, with follow-up control; Schedule 7122—one telephone switchboard, front-connection type (type C-72) and spare parts, 32 commercial telephones complete, similar to type HB, 75 telephones, HB, DB, D, HBc, complete, and spare parts; Schedule 7119—200 storage batteries, f.o.b. works. Norfolk, Va., Schedule 7131—three deck covers for storage batteries; Schedule 7112—32 automatic controlling equipments for operation of engine-room ventilation sets and spare parts, 24 to be delivered to Brooklyn, N. Y., and eight to Norfolk, Va. Washington, D. C., Schedule 7119—two switchboard panels, or contactor, suitable for 20-hp shunt-wound, 220-volt, direct-current motor; Schedule 7134—5500 cable terminals, type V, 2000 5-amp snap switches; Schedule 7118—miscellaneous rolled naval brass rod, in commercial lengths, miscellaneous naval bronze rod, 500 lb. copper rod, ⅞-in. diameter, commercial lengths; Schedule 7130—11,500 lb. naval brass rod, miscellaneous rolled naval brass rod, in commercial lengths. Boston, Mass., Schedule 7123—miscellaneous boiler tubes. Charleston, S. C., Schedule 7123—5550 lb. copper tubing, 12-ft. lengths. Bids will also be received until Sept. 1 for one 7½-kw turbo-generator set and spare parts, to be delivered at Puget Sound, Wash., as per Schedule 7115. Applications for schedule should designate the schedule desired by number.

North Central

BESSEMER, MICH.—The city of Bessemer has entered into a new contract with the Gogebic & Iron Counties Ry. & Lt. Co., under the terms of which the company will furnish the city 135 lamps for the same price that it formerly paid for 73 lamps. Ornamental lamps will be installed on several blocks.

DETROIT, MICH.—Bids will be received by Marcus L. Freud, Dime Bank Building, Detroit, for an electric motor to be installed in one of the State institutions.

DETROIT, MICH.—Plans, it is reported, have been prepared by Preston, Brown & Walker, Dime Bank Building, Detroit, for the installation of a power plant in the new factory of the Utility Pwr. Co.

DETROIT, MICH.—Bids will be received by Charles A. Gadd, secretary of board of education, until Aug. 11 for construction of a 16-room school building, adjoining the Fairbanks School building, at Hamilton and Seward Avenues.

ESCANABA, MICH.—Arrangements have been made by the Escanaba Trac. Co. for the construction of a third dam and hydro-electric plant on the Escanaba River. The power house will be located about 1000 ft. below Chandler Falls and will be equipped to generate 1000 hp. Practically all energy generated at the plant will be supplied to a large pulp-box factory to be erected at Wells by Milwaukee capitalists. P. L. Utley, secretary and general manager of the Escanaba Trac. Co., will have charge of the work.

MENOMINEE, MICH.—The Dugas Motor Car Co. is contemplating the erection of a garage in Menominee, which will be equipped with an electric charging battery sufficient to take care of charging of all electric cars in this district.

SAGINAW, MICH.—The city of Saginaw is considering the installation of a new municipal electric-light plant. A new system of street-lighting will also be installed. For further information address Herman H. Eymer, city engineer.

URBANDALE, MICH. — Arrangements have been made for the installation of an electric-lighting system in Urbandale. The present plans also provide for the erection of electric lamps on every street and the entire distance on Main Street, from Battle Creek to this village. Energy for operating the system will be supplied from the Battle Creek plant. Urbandale has not a post office.

ASHLAND, OHIO.—Arrangements, it is reported, have been completed for the erection of an addition to the plant of the Maiwurn German Aluminum Co. The new building will be 75 ft. by 40 ft. and will be equipped throughout with electric-motor-driven machinery. A 110-hp gas engine to drive a 75-kw generator will be installed.

CANTON, OHIO. — Announcement has been made that the contract for suction sweepers in seven buildings of the Canton Public Schools has been awarded to T. J. Thomas, sales manager of the United El. Co., of Canton.

CINCINNATI, OHIO.—Plans are being considered by the Main Street Merchants' Association for the installation of an ornamental street-lighting system on Main Street.

HAMILTON, OHIO.—Plans are being considered by Public Service Director Myers for the installation of a new electric generating unit in the municipal electric-light plant, to cost $55,000.

MASON, OHIO.—Arrangements have been made for the construction of a municipal electric-light plant, for which $14,000 in bonds has been issued.

SYCAMORE, OHIO.—Bids will be received by O. J. Niebel clerk board of trustees of public affairs, until Aug. 14 for improvements to the municipal electric-light plant and water-works system. Plans may be obtained at the above office or from George Champe, consulting engineer.

YOUNGSTOWN, OHIO.—Plans for the complete readjustment of the street-lighting system have been decided upon which provide for replacing the 750 arc lamps now in use with 3750 tungsten lamps, the figures being based on lamps of 100 cp. H. Whitford Jones, of Cleveland, is consulting engineer.

MONTICELLO, KY.—The proposal to issue bonds for the installation of an electric-light plant and water-works system will be submitted to the voters at the regular election to be held Nov. 3.

EAST GARY, IND.—Bonds to the amount of $10,000 have been authorized by the Town Board for the erection of a transmission and distributing system. Electricity for operating the system, it is reported, will be obtained from the Calumet El. Co.

TELL CITY, IND.—The contract for remodeling the municipal electric-light plant has been awarded to the General Electric Co., for $13,055.

ALTON, ILL.—Bids will be received at the office of the Board of Administration, Capitol Building, Springfield, until Aug. 31 for the erection of administration building, receiving hospital, cottage for untidy female patients and nurses' home on the site for the Alton State Hospital, near Upper Alton. Plans and specifications may be obtained upon application to James B. Dibelka, state architect, 29 South La Salle Street, Chicago, Ill.

CHICAGO, ILL.—The Illinois Public Utilities Commission has granted the Public Service Co. of Northern Illinois a certificate of convenience for the erection of transmission lines from Streator to Grande Ridge, from Kankakee to Chebanse and from Henry to Spring Grove, Solon Mills and Richmond.

SPRINGFIELD, ILL.—Bids will be received by the Board of Administration, Capitol Building, Springfield, Ill., until Aug. 18 as follows: For addition to school building and three cottages at the St. Charles School for Boys at St. Charles, plans and specifications may be secured upon application to James B. Dibelka, state architect, 29 South La Salle Street, Chicago. For rehabilitation of the power plant at the Soldiers' Orphans' Home, at Normal; plans and specifications may be secured upon application to C. E. Bassett, managing officer of the institution. Repairs and mason work for four horizontal water-tube boilers at the Anna State Hospital, at Anna; plans and specifications may be seen at the office of the managing officer of the institution.

SPRINGFIELD, ILL.—Bids will be received by the Board of Administration, Capitol Building, Springfield, until Aug. 18 for the erection of buildings, plumbing, heating, sewers, etc., as follows: One cottage for tubercular patients at the Anna State Hospital, Anna; one cottage for tubercular patients at the Kankakee State Hospital, Kankakee; one cottage for tubercular patients, one building for female employees and amusement hall at the Watertown State Hospital, Watertown; administration building, receiving buildings and two cottages at the Chicago State Hospital, at Dunning; one cottage for tubercular patients, two cottages at the Lincoln State School and Colony, at Lincoln; three farm cottages at the St. Charles School for Boys, at St. Charles. Plans and specifications may be obtained upon application to James B. Dibelka, state architect, 29 South La Salle Street, Chicago.

URBANA, ILL.—The contract for the construction of the addition to the power house of the University of Illinois has been awarded to Freeman & Brooks, of Champaign, at $44,800. The equipment will include two 500-hp Babcock & Wilcox water-tube boilers, fitted with Greene stokers.

WAUWATOSA, WIS.—The contract for the construction of the power house for the tuberculosis sanatorium at Wauwatosa has been awarded to the American Construction Co., at $37,500.

BRAINERD, MINN.—Bids will be received at the office of V. N. Roderick, city clerk, Brainerd, until Aug. 17 for the construction of a city hall and building and a fire station building at Brainerd, including general contract work, heating, plumbing and electrical work, in accordance with plans and specifications prepared by Alden & Harris, architects, Commerce Building, St. Paul. Separate bids to be submitted for each part of the work. Copies of plans may be seen at the St. Paul, Duluth and Minneapolis Builders' Exchanges. Extra copies of plans and specifications may be obtained on application to the architects upon deposit of $25, of which $15 will be refunded upon return of same.

BUHL, MINN.—The contract for improvements to the municipal electric-light plant and water-works system has been awarded to R. B. Whitaker & Co., of St. Paul, to cost about $50,000. The work includes construction of new tank, installation of new machinery and the erection of a new smokestack.

CEYLON, MINN.—The city of Ceylon has engaged Earle D. Jackson, of St. Paul, consulting engineer, to prepare plans for a municipal electric-light plant. Bids are being asked for the sale of $8,000 in bonds for construction of light plant and extending water mains. F. H. Koenecke is city clerk.

DODGE CITY, MINN.—A franchise has been granted to a private company to install an electric-light plant in Dodge City. The company would like to receive prices on a 50-kva or 75-kva, three-phase, 60-cycle, 2300-volt generator (either new or second hand). Homer G. Hall, manager, has charge of the installation.

GOOD THUNDER, MINN.—The Good Thunder El. Co. has been granted permission to erect transmission lines along the public highway in the townships of Rapidan and Lyra and the village of Good Thunder.

MINNEAPOLIS, MINN. — The State Board of Control has awarded the contract for heating, lighting and plumbing work at the State Public School in Owatonna to the Clefton Co., of Owatonna, at $16,467.

DENISON, IA.—The contract for construction of the power house for the municipal electric-light plant has been awarded to Fee & Kobler, at $5,740, and for furnishing electrical machinery to the McGraw Co., of Omaha, Neb. The plans provide for Murray engines and Westinghouse generators. Owing to a change in current a complete change in meters will be necessary.

GALVA, IA.—Plans have been prepared by the E. L. Snyder Engineering Co. for the construction of an electric-light plant and water-works system. The equipment will consist of a 50-hp engine, 35-kw generator and steam pump. The cost of the plant is estimated at $6,000.

LUZERNE, IA.—At an election to be held Aug. 17 the proposal to grant the Iowa Ry. & Lt. Co., of Cedar Rapids, a franchise to furnish electrical service in Luzerne will be submitted to the voters.

LYONS, IA.—The contract for installing the proposed ornamental street-lighting system has been awarded to H. J. Overkamp. The plans provide for 54 iron standards, made by the Iowa Machine Co., of Clinton, each carrying one 100-watt and four 60-watt incandescent lamps, maintained by underground wires. The cost is estimated at about $70 per post complete. M. F. Henle is president of the Commercial Club.

MANILLA, IA.—The Standard El. Construction Co., of Waterloo, has been awarded the contract for the installation of a complete overhead distribution system, together with 14 electroliers.

SWEA CITY, IA.—The contract for the installation of a complete electric-lighting system, including a Murray Corliss engine and boiler, has been awarded to the Standard El. Construction Co., of Waterloo.

VANCLEVE, IA.—Bids will be received by the Consolidated Independent School District of Vancleve until Aug. 24 for construction of school building. Separate bids to be submitted for heating, plumbing and electrical wiring. J. F. Ingels is secretary board of directors.

AUXVASSE, MO.—Application has been made to the Public Service Commission by M. R. Kennedy for permission to install an electric-light plant in Auxvasse.

BIRCH TREE, MO.—Franchises, it is reported, have been granted to W. J. Duffield for the installation of an electric-light plant and water-works system. The electric-light plant, it is understood, will be installed at once.

HOPKINS, MO.—D. A. Dalbey, of Grant City, recently granted a franchise, is planning to install an electric-light plant in Hopkins, to cost about $10,000; he will also install an ice plant.

GROTON, S. D.—The Groton Lt., Ht. & Pwr. Co. expects to purchase one 125-hp boiler, one 60-kw generator, one 35-kw generator and one 60-hp oil engine. J. D. Jones is secretary.

BLAIR, NEB.—At an election held recently the proposal to establish a municipal electric-light plant was defeated.

LARNED, KAN.—Bids will be received by the city clerk, Larned, until Aug. 14 for electric-light plant. Worley & Black, Reliance Building, Kansas City, Mo., are engineers.

SALINA, KAN.—The Salina Lt., Pwr. & Gas Co. is planning to build an addition to its boiler room and to install one 400-hp boiler, erect cooling tower, remodel switchboard and reconstruct a good portion of its lines. J. E. Harsh is manager.

TOPEKA, KAN.—F. M. Newland, commissioner of light and water, in his budget for 1915, asks for a new generating unit to supply electricity for street-lighting, to be installed in the municipal electric-light plant. The cost of the equipment is estimated at $4,500.

Southern States

CONCORD, N. C.—The city of Concord is contemplating the installation of an ornamental street-lighting system, bids for which are now being received. L. A. Fisher is superintendent of the municipal electric-light plant.

DENMARK, S. C.—The citizens have voted to install an electric-lighting system in Denmark.

WALHALLA, S. C.—Bids, it is reported, will be received by the city of Walhalla until Aug. 12 for the erection of a pole-line distribution system. The J. B. McCrary Co., Third National Bank, Atlanta, Ga., is consulting engineer.

PAVO, GA.—At an election held recently the proposal to issue bonds for the installation of an electric-lighting system was carried. The citizens have also subscribed $600 toward a fund for ornamental lamps in the business district.

PALATKA, FLA.—The property of the Palatka Lt. & Pwr. Co., it is reported, has been purchased by Paul H. Norcross, of the Solomon-Norcross Co., of Atlanta, Ga. The plant, it is understood, will be rebuilt.

CUMBERLAND GAP, TENN.—The Kentucky Utilities Co., having obtained the right-of-way over the mountains, has contracted with the town of Cumberland Gap to furnish electrical service here. The company will also supply energy to maintain the electric system at the Lincoln Memorial University, near here.

LEBANON, TENN.—A movement has been started by the Business Men's Association to establish an ornamental street-lighting system on the Public Square and intersecting streets of Lebanon. L. K. Grigsby is chairman of committee.

CITRONELLE, ALA. — The Citronelle Pub. Ser. Corpn., recently incorporated, is planning to install an electric-light plant here. The power house will be 57 ft. by 32 ft., and will be equipped to develop 75 kw; 5 miles of transmission lines will be erected, of which 2 miles have been completed. The company will also install a 6-ton to 8-ton ice machine, and would like to receive estimates on ice and electrical machinery. Edward P. Corey, of Citronelle, is president, and Eliott C. Wells, of Citronelle, is engineer.

FLORENCE, ALA.—Arrangements, it is reported, have been made by N. F. Thompson, of Birmingham, for the purchase of the Cypress Creek property, including 1100 acres and three water-powers, which he proposes to develop.

MABEN, MISS.—The Board of Aldermen has granted F. H. Mudd a franchise to install and operate an electric-light plant in Maben.

WESSON, MISS.—The contract for rebuilding the local electric-light plant, recently destroyed by an explosion, has been awarded to Dabbs & Wetmore, of Meridian.

GLENWOOD, ARK.—The Town Council has granted John Peden, of Heber Springs, a franchise to construct and operate an electric-light plant in Glenwood.

BREAUX BRIDGE, LA.—Bids will be received by the city of Breaux Bridge until Aug. 20 for the purchase of $12,000 electric-light and water extension bonds. C. C. Rees is Mayor.

GUTHRIE, OKLA.—The City Commis-

sioners have called an election, to be held Aug. 11, to vote on the proposal to purchase the electric-light and power plant (estimated cost, $250,000) and to issue bonds for same; also to vote on a bond issue of $25,000 for improvements to the water-works system.

GONZALES, TEX.—All bids received July 20 by the Gonzales Wtr. Pwr. Co. for construction of a reinforced-concrete dam on the Gonzales River have been rejected. New bids will be received at the office of Frank S. Taylor, Scarborough Building, Austin, Tex., until Aug. 12.

HOUSTON, TEX.—The City Council has passed an ordinance requiring the Houston El. Co. to construct a double-track railway on several streets of the city.

LOCKHART, TEX.—Within the next 90 days the Lockhart Water Works expects to purchase one carload of poles, 30 ft. long (7-in. top); also a carload of 4-in. water mains within the next 30 days. C. E. Jones is manager.

SAN ANTONIO, TEX.—The San Antonio & Austin Interurban Ry. Co., it is reported, is negotiating for the sale of $2,000,000 in bonds, to provide funds for the construction of an electric railway and power station. The proposed line is to run between San Antonio and Austin, a distance of about 85 miles.

TEAGUE, TEX.—The Magnolia Petroleum Co. is erecting a large pumping station on its pipe line about 2 miles below Teague. The company will install an electric-light plant and water system.

Pacific States

CHEHALIS, WASH.—The City Council has passed the ordinance granting an electric light and power franchise to B. F. Walling, Jr., representing Eastern capitalists. The question of granting the franchise will be submitted to the voters at a special election to be held Sept. 8.

TACOMA, WASH.—The Mutual El. Lt. & Pwr. Co. has applied to the Commissioners of Pierce County for a 25-year franchise to construct and operate an electric light and power system and telephone lines on Pioneer Way and a number of country roads.

PASADENA, CAL.—The City Commissioners have decided to install a new 3000-kw, 50-cycle, 2300-volt generator in the municipal electric-light plant, bids for which will be received until Aug. 11. The additional unit will double the output of the plant and will cost about $30,000. C. W. Koiner is general manager.

LOS BANOS, CAL.—Surveys are being made by the San Joaquin Lt. & Pwr. Co., of Fresno, for the erection of an additional transmission line from Los Banos to the Oro Loma country.

WATTS, CAL.—The power house of the Pacific El. Ry. Co. at Watts was damaged by fire recently.

CULDESAC, IDAHO.—The City Council has granted W. L. Marrs, of Cœur d'Alene, a franchise to construct and operate an electric-light plant in Culdesac. Work on construction of the plant, it is understood, will begin about Sept. 1.

EPHRAIM, UTAH.—The electric light commission expects to purchase within the next two months three transformers and 75 meters. J. H. Jensen is city electrician.

EUREKA, UTAH.—Work, it is understood, will soon begin on the erection of the new substation of the Utah Pwr. Co. to furnish electricity in this district. The building will be 50 ft. by 70 ft.

PHOENIX, ARIZ.—The Secretary of the Interior has authorized the Reclamation Service to execute a contract with the General Electric Co., of Schenectady, N. Y., for one vertical alternating-current generator for the Salt River irrigation project, to cost $23,852.

HAVRE, MONT.—Improvements and extensions, it is reported, are contemplated by the Havre El. Co., involving an expenditure of about $50,000.

DENVER, COL.—Merchants and property owners on California Street, from Fifteenth to Eighteenth Street, have submitted a proposal to the City Commission offering to supply the standards and lamps for an ornamental lighting system provided that the city will maintain same. Property owners on several other streets have offered to install ornamental lamps and standards if the city will bear the cost of maintenance.

EATON, COL.—The Farmers' El. & Pwr. Co., recently organized, has taken over the property of the Eaton Pwr. Co., of Eaton. The company is capitalized at $50,000 and will furnish electricity for lamps and motors in Eaton and surrounding country.

FORT COLLINS, COL.—Preparations, it is reported, are being made by the Great Western Granite Mfg. Co., of Fort Collins, for the erection of a power plant, 32,000 ft. of 26-in. pipe line and a large finishing plant, bids for which will be asked early in the fall.

Canada

FORT FRASER, B. C.—Plans have been filed by the Vanderhoof Pwr. Co., of Victoria, B. C., for the construction of two dams (capacity 10,000 acre-ft.) at Fort Fraser.

KAMLOOPS, B. C.—The government telephone and telegraph system in and around Kamloops, including Shuswap Lake and North Thompson, it is understood, will be reconstructed and extended. The cost of the work is estimated at about $110,000. J. T. Whalen is general superintendent of the Dominion government telephone and telegraph system.

VICTORIA, B. C.—The new Royal Jubilee Hospital, for which tenders were recently awarded covering the first unit of construction, which consists of a brick power house and laundry buildings, will be equipped with an isolated electric plant, plans for which have been prepared by H. C. Moss, of Seattle, Wash. The initial installation will consist of one 75-kw and one 125-kw turbo-generator set, provision being made for duplicating the equipment for future extensions. Plans for the electrical equipment include the installation of fixtures and lamps complete, designs of the fixtures being furnished. A special signal system will be installed to operate in conjunction with the clock system. Electrically heated Gurneys are to be provided for conveying food from the kitchen to the different wards.

CHATHAM, ONT.—The City Council has adopted a resolution authorizing the opening of negotiations with the Hydro-Electric Commission of Ontario for electricity; also declaring all negotiations with the Chatham Gas Co. at an end.

PETERBOROUGH, ONT.—The City Council has decided to take the necessary steps to secure authority to take over the property of the Peterborough Lt. & Pwr. Co., which has been expropriated, the city to pay the company $100,000, the amount fixed by the Hydro-Electric Commission.

ST. THOMAS, ONT.—The City Council is reported to have decided to replace the arc lamps now in use on Talbot Street with nitrogen tungsten lamps. The wooden poles, it is understood, will be replaced by metal combination trolley and lamp-posts.

WALKERVILLE, ONT.—The Hydro-Electric Power Commission of Ontario is planning to furnish hydroelectric power in Walkerville and has offered the Walkerville Lt. & Pwr. Co. $75,000 for its plant and property, which was refused. The company, it is reported, places the valuation at $84,500.

SWIFT CURRENT, SASK.—Debentures to the amount of $196,000 have been issued by the town of Swift Current for local improvements, of which $60,000 will be used for a municipal electric-light plant.

Miscellaneous

PANAMA,—Bids will be received at the office of the general purchasing officer of the Panama Canal, Washington, D. C., until Aug. 17 for furnishing shell hoists, motor-driven pumps and float switches for fortifications. Blanks and general information relating to this circular (No. 863) may be obtained from the above office or the offices of the assistant purchasing officers, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal.

New Incorporations

DETROIT, FLA.—The Detroit Ice, Lt. & Pwr. Co. has been organized with a capital stock of $25,000 for the purpose of constructing an electric-light and ice plant. The officers are: F. W. Symmes, president; M. G. Tracy, vice-president, and C. F. Keep, secretary and treasurer.

BUTLER, IND.—The Butler Utilities Co. has been chartered with a capital stock of $25,000 by C. M. Lott, W. F. Shumaker and E. A. Farnham. The company proposes to furnish water, light, heat and power.

CONNERSVILLE, IND.—The Connersville Hydraulic Co. has been incorporated with a capital stock of $10,000 to furnish hydraulic power, etc. The incorporators are P. H. Roots, F. M. Roots and M Pfafflin.

VINAL HAVEN, MAINE.—The Vinal Haven El. Pwr. Co. has been incorporated with a capital stock of $50,000 to generate and distribute electricity. F. S. Walls is president, and T. E. Libby, treasurer, both of Vineland.

RENO, NEV.—The Portneuf Pwr. Co. has been incorporated by A. D. Ayres, E. C. Dalzel and D. C. Papson. The company is capitalized at $100,000 and proposes to acquire and distribute electricity for lamps, heaters and motors.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY 28, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,104,761. CAR TRUCK; W. S. Adams, Philadelphia, Pa. App. filed Sept. 5, 1913. Leaf-spring mounting for swing bolster truck.

1,104,784. DYNAMO-ELECTRIC MACHINE FRAME; G. Dunn, East Orange, N. J. App. filed April 19, 1910. Special means for centering the rotor.

1,104,785. MOTOR-CONTROL SYSTEM; G. Dunn, New York, N. Y. App. filed Jan. 4, 1913. For rolling mills of the two-high type.

1,104,789. MACHINE FOR INCLOSING CORDS IN TIRE WRAPPERS; E. W. Fothergill, Hartford, Conn. App. filed May 22, 1913. Inserts a tearing cord between the tire or coil and the paper wrapper being applied to the same.

1,104,793. ELECTRICAL GENERATING SYSTEM; L. V. Grillet and J. B. Truchetet, Paris, France. App. filed Oct. 18, 1911. Armature is longitudinally movable to vary the output of the machine.

1,104,795. MAGNETO; E. Hahnlen, Roxbury, Mass. App. filed Aug. 22, 1912. Manually oscillates the armature from the steering post for starting.

1,104,796. ELECTRIC CIRCUIT REGULATOR; C. Aalborg, Wilkinsburg, Pa. App. filed March 9, 1908. Automatically renders the movements of the regulator coils interdependent and has means for locking the coils at a predetermined point of travel.

1,104,800. MOTOR CONTROLLER; A. J. Horton, White Plains, N. Y. App. filed Oct. 16, 1911. Reversing and resistance-controlling device.

1,104,807. ELECTRIC INCANDESCENT LAMP; A. S. Knight, Newark, N. J. App. filed May 16, 1910. Has straight tungsten filaments stretched between the ends thereof.

1,104,828. GALVANIC BATTERY; J. E. Preston, Stockport, Eng. App. filed Nov. 12, 1910. Reversible type; has special seating and insulating means.

1,104,835. MAGNETO IGNITION DEVICE; F. Schröter and F. L. Madler, Wilmersdorf-Berlin, Germany. App. filed Jan. 23, 1913. Sends the current through the armature in alternating directions.

1,104,841. RESISTANCE SET; I. B. Smith, Ambler, Pa. App. filed March 12, 1913. Has a special construction of contacts for cutting in and out the resistance units.

1,104,842. METHOD OF PLATING; J. A. Smith, Attleboro, Mass. App. filed Feb. 27, 1914. Coats with gold solder, plates with gold and heats.

1,104,849. VOLTAGE REGULATOR; W. A. Turbayne, Buffalo, N. Y. App. filed May 1, 1911. Car-lighting system with a vibrating short-circuit device.

1,104,860. IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES; G. V. Ahara, Toronto, Canada. App. filed June 5, 1913. Magneto operated from the fuel-pump-operating mechanism; for stationary engines.

1,104,898. METHOD OF MAKING STORAGE-BATTERY ELECTRODES; H. C. Hubbell, Newark, N. J. App. filed Nov. 18, 1912. Mixes precipitated active material with conducting elements, dries to thick dough, forms into cakes, dries and strongly compresses.

1,104,908. ANTISEPTIC PROTECTOR; T. Lamb, Brooklyn, N. Y. App. filed Dec. 9, 1912. For telephone mouthpiece or receiver.

1,104,930. ELECTRIC WALL BOX; J. G. Itaquette, Cleveland, Ohio. App. filed May 25, 1912. Constructed so that a number can be assembled in a gang.

1,104,931. SOCKET FOR INCANDESCENT ELECTRIC LAMPS; A. C. Recker, Oakville, Conn. App. filed Oct. 27, 1913. Has a ring attached to the neck thereof for use in suspension fixtures.

1,104,939. ELECTRIC MUSICAL INSTRUMENT; M. L. Severy, Arlington Heights, and G. B. Sinclair, Winthrop, Mass. App. filed Feb. 23, 1906. Strings are vibrated by the pulsatory magnetic attraction of electromagnets.

1,104,956. TELEPHONE OPERATOR'S EQUIPMENT; W. G. Blauvelt, New York, N. Y., and E. C. Molina, Bloomfield, N. J. App. filed March 14, 1910. Reduces the number of acts and the mental effort required in making connections.

1,104,959. VACUUM LIGHTNING ARRESTER; F. S. Chapman, Toledo, Ohio. App. filed July 9, 1912. One or both the electrodes are inclosed within shields of material to withstand the intense heat produced by the static discharge.

1,104,960. LIGHTNING ARRESTER; F. S. Chapman, Toledo, Ohio. App. filed Dec. 24, 1912. Has provision for permanently spacing and supporting the electrodes in the evacuated vessel.

1,104,969. PULP DISTRIBUTER FOR CONCENTRATORS; W. E. Darrow, Sutter Creek, Cal. App. filed July 28, 1913. Rotary type; keeps the pulp in continuous motion.

1,104,978. PROCESS OF PRODUCING ACETIC ACID; E. H. French, Dayton, and J. R. Withrow, Columbus, Ohio. App. filed July 9, 1909. Subjects the distillate from acetate of lime to electrolysis.

1,105,014. TRANSFORMER; W. M. Austin, Zelienople, Pa. App. filed Feb. 23, 1911. Core lamina having hexagonal contour and a hexagonal aperture.

1,105,015. ELECTROLYTIC CELL; D. B. Ayerst, Wilmington, Del. App. filed Feb. 24, 1913. Keeps the diaphragm clean, keeps electrolyte practically in saturation and regulates its temperature, and frees it of the chlorine as it is given off.

1,105,029. AUTOMATIC COMMUTATOR FOR RADIOTELEGRAPHIC PLANTS WITH INDIRECT EXCITATION; E. Girardeau, Paris, France. App. filed Dec. 4, 1911. Plant automatically made ready as a receiver as soon as the lever of the key is released.

1,105,035. AUTOMOBILE LIGHT; A. L. McMurtry, Sound Beach, Conn. App. filed Aug. 31, 1912. Shifting of transmission lever into reverse position closes circuit through a searchlamp at the rear.

1,105,044. FIRE-ALARM SYSTEM; E. Schumann, Charlottenburg, Germany. App. filed June 28, 1913. Connection made to ground only upon alarm being given or wire broken.

1,105,050. SUPPORT FOR FILAMENTS; W. R. Whitney, Schenectady, N. Y. App. filed June 14, 1907. Coiled spring of tungsten supports a tungsten filament.

1,105,066. TELEGRAPHIC TRANSMITTER; J. J. Comer, Santa Monica, Cal. App. filed March 4, 1907. An insulating strip extends into the carbon granules to separate two electrodes and deflect the path of current from one to the other.

1,105,070. ARTIFICIAL RESISTANCE; G. J. Gage, Hillyard, Wash. App. filed March 31, 1913. Graphite and carborundum with a binder of silica.

1,105,144. DRY-BATTERY CONTAINER; H. T. Johnson (deceased), New York, N. Y. App. filed July 18, 1912. Carton with closing flaps through which the terminal wires are passed.

1,105,155. SELF-REGULATING DYNAMO; T. M. Mueller, Detroit, Mich. App. filed May 15, 1913. Automatic means for changing from shunt-wound machine to compound-wound and back to shunt-wound.

1,105,175. ROTARY ELECTRIC FURNACE; A. S. Bemis, Cleveland, Ohio. App. filed Jan. 22, 1912. Has a hollow electrode through which the material feeds onto a flat rotating electrode.

1,105,194. SELECTIVE MECHANICAL OPERATOR; E. R. Gill, Yonkers, N. Y. App. filed May 25, 1905. Wheel or like element rotated by a predetermined step-by-step action. (110 claims.)

1,105,230. TOASTER; S. A. Wiltsie, Erie, Pa. App. filed Jan. 22, 1912. Has a swinging carrier which automatically reverses the toast.

1,105,231. SYSTEM OF ELECTRICAL DISTRIBUTION; J. L. Woodbridge, Philadelphia, Pa. App. filed July 28, 1906. Special booster control.

1,105,232. SYSTEM OF ELECTRICAL DISTRIBUTION; J. L. Woodbridge, Philadelphia, Pa. App. filed April 20, 1909. Storage battery relieves the generating source of load fluctuation or provides uniform distribution of load over several phases.

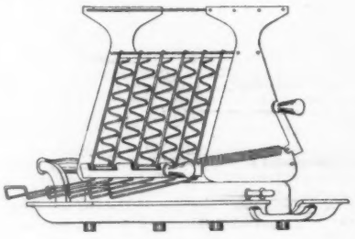
1,105,267. INSULATING BLOCK; A. E. Goetz, New York, N. Y. App. filed Dec. 31, 1913. Insulating base for insertion in metallic molding.

1,105,284. ELECTRICAL OUTLET BOX AND THE LIKE; A. McMurtrie, New York, N. Y. App. filed Jan. 15, 1906. Has means for attaching it to an I-beam.

1,105,292. APPARATUS FOR ELECTROPLATING AND THE LIKE; A. Murphy, Quincy, Mass. App. filed Oct. 22, 1913. For small articles; has revolvable outer conical vessel.

1,105,293. MAGNETIC SEPARATOR; H. J. H. Nathorst, Malmberget, Sweden. App. filed March 5, 1913. Rotating drum with electromagnets of alternating polarity within the same.

1,105,305. LAMP-SOCKET SHELL; H. E. Reeve, New York, N. Y. App. filed March 8, 1911. Has a boss serving as a thumb-hold for releasing the catch which secures the cap in place.



1,105,230—Toaster.

1,105,311. ALTERNATING-CURRENT ELECTROMAGNETIC SWITCH; A. Sundh, Yonkers, N. Y. App. filed Nov. 22, 1907. Substantially silent in operation and chattering minimized.

1,105,324. MECHANICAL HORN; G. C. Dean, Bronxville, N. Y. App. filed July 10, 1911. Motor casing has a threaded engagement with diaphragm casing to provide for adjustment.

1,105,329. CABLE TELEGRAPHY; I. Kitsee, Philadelphia, Pa. App. filed Oct. 28, 1908. Includes two sources of current connected in opposition at transmitting station, with a condenser and transformer at receiving end.

1,105,344. TELEPHONE SYSTEM; E. R. Corwin, Chicago, Ill. App. filed June 21, 1909. Calling lines automatically connected with responsive apparatus belonging to operators that are not busy. (Fifty-four claims.)

1,105,345. TELEPHONY; E. R. Corwin, Chicago, Ill. App. filed April 24, 1911. Either of two telephone lines may be connected with a third line and establish a busy-test condition in connection with the third line.

1,105,346. TELEPHONY; M. L. Johnson, Chicago, Ill. App. filed May 22, 1911. Selecting mechanism also applies ringing current.

1,105,347. TELEPHONY; M. L. Johnson, Chicago, Ill. App. filed Aug. 10, 1911. Has a common-battery exchange and a second common-battery exchange connected thereto by a trunk line, together with link connectors for the lines leading to the exchanges. (Thirty-two claims.)

1,105,348. TELEPHONE SYSTEM; C. A. Bals, Chicago, Ill. App. filed June 24, 1912. Intercommunication without the aid of an exchange.

1,105,349. SWITCHING MECHANISM; C. A. Bals, Chicago, Ill. App. filed June 24, 1912. For intercommunicating telephone systems.

1,105,350. SIGNALING SYSTEM; M. L. Johnson, Chicago, Ill. App. filed July 15, 1912. Signal receivers selectively associated with telephone lines.

1,105,361. IGNITION DYNAMO; C. T. Mason, Sumter, S. C. App. filed May 10, 1912. Permanent magnets and an adjustable field structure. (Thirty-nine claims.)

1,105,385. PROTECTING HIGH-VOLTAGE TRANSFORMER; M. O. Troy, Schenectady, N. Y. App. filed Nov. 14, 1908. A small auxiliary transformer interposed between the line and the main transformer serves as a buffer.

1,105,392. CIRCUIT PROTECTION; G. Wright, Schenectady, N. Y. App. filed Dec. 26, 1913. Circuit-interrupting means is caused to open after conditions of excessive current flow have ceased.

1,105,399. CONTACT POINT; J. F. Cadell, Baltimore, Md. App. filed June 15, 1907. platinum tip upset over a conical recessed boss.

1,105,436. POLICE AND FIRE-ALARM SYSTEM; G. L. Hughes, Chicago, Ill. App. filed Feb. 12, 1913. Combined with common-battery telephone system.

1,105,465. EXCESS ELECTRIC-CURRENT INDICATOR; J. Stone, Pittsburgh, Pa. App. filed Feb. 9, 1912. Resistance automatically inserted in circuit, rendering the energy-consuming devices inoperative when it is attempted to take more than the agreed amount of current.

1,105,481. ELECTRICAL MEASURING INSTRUMENT; R. P. Brown, Philadelphia, Pa. App. filed Feb. 12, 1913. D'Arsonval galvanometer having a core guided and supported between the pole faces on a sliding bracket.

1,105,485. INTERCOMMUNICATING TELEGRAPH OR TELEPHONE DEVICE; A. C. Carlson, Butler, Pa. App. filed Feb. 6, 1912. Breaks one circuit when another is closed, thus releasing other circuits when it is desired to use one circuit.

1,105,489. ELECTRICAL CONTACT; E. E. Clement, Washington, D. C. App. filed Sept. 29, 1906. Narrow strips of platinum rolled or plated on a blank from which contact springs are cut.

1,105,490. TELEPHONE-EXCHANGE SYSTEM; E. E. Clement, Washington, D. C. App. filed Nov. 26, 1906. Semi-automatic. (Twenty-five claims.)

1,105,491. ELECTRICAL SELECTIVE SWITCH; E. E. Clement, Washington, D. C. App. filed April 12, 1906. Special construction of contacts and electromagnetic operating means.

1,105,492. TELEPHONE EXCHANGE SYSTEM; E. E. Clement, Washington, D. C. App. filed Oct. 26, 1907. Reduces the time required for sending the impulses for operating the automatic switches. (Twenty-two claims.)

1,105,499. STORAGE-BATTERY PLATE; R. Drambourg, New York, N. Y. App. filed July 19, 1913. A hollow unit within the cell and fitted to hold electrolyte supports the plates of different polarity.

1,105,504. COAT AND HAT PROTECTOR; E. Gargon, Philadelphia, Pa. App. filed April 16, 1913. Key-operated; gives signal if mistake is made.

1,105,521. INSULATOR ATTACHMENT; J. A. Kephart, Wellston, Okla. App. filed Aug. 15, 1913. Wire-holding clamp.

1,105,538. ELECTRIC FURNACE; H. F. D. Schwahn, Belleville, Ill. App. filed Sept. 26, 1912. A resister over checkers on a false bottom divides the furnace into an upper and a lower chamber.

1,105,545. TELEPHONE EXCHANGE SYSTEM; E. E. Clement, Washington, D. C. App. filed April 10, 1914. Operator can directly control the connection without waiting for the various switches to complete their several operations. (Fifty-three claims.)

1,105,557. ARRESTER FOR STRONG CURRENTS; H. W. Garton, Brooklyn, N. Y. App. filed July 22, 1913. Embodies a rectangular member having hygroscopic qualities interposed between the live and ground terminals.

1,105,563. TELEPHONY; M. L. Johnson, Chicago, Ill. App. filed Aug. 10, 1911. Particularly for private branch exchanges. (Twenty-eight claims.)

1,105,564. TELEPHONY; C. A. Bals, Chicago, Ill. App. filed June 27, 1913. Circuit-changing keys with elements holding them in actuated position and a bar common to all keys for restoring them.

1,105,589. TELEPHONE EXCHANGE SYSTEM; E. E. Clement, Washington, D. C. App. filed Dec. 28, 1905. Calling subscribers answered by operators and the desired connections effected by automatic mechanism controlled from the subscriber's station.